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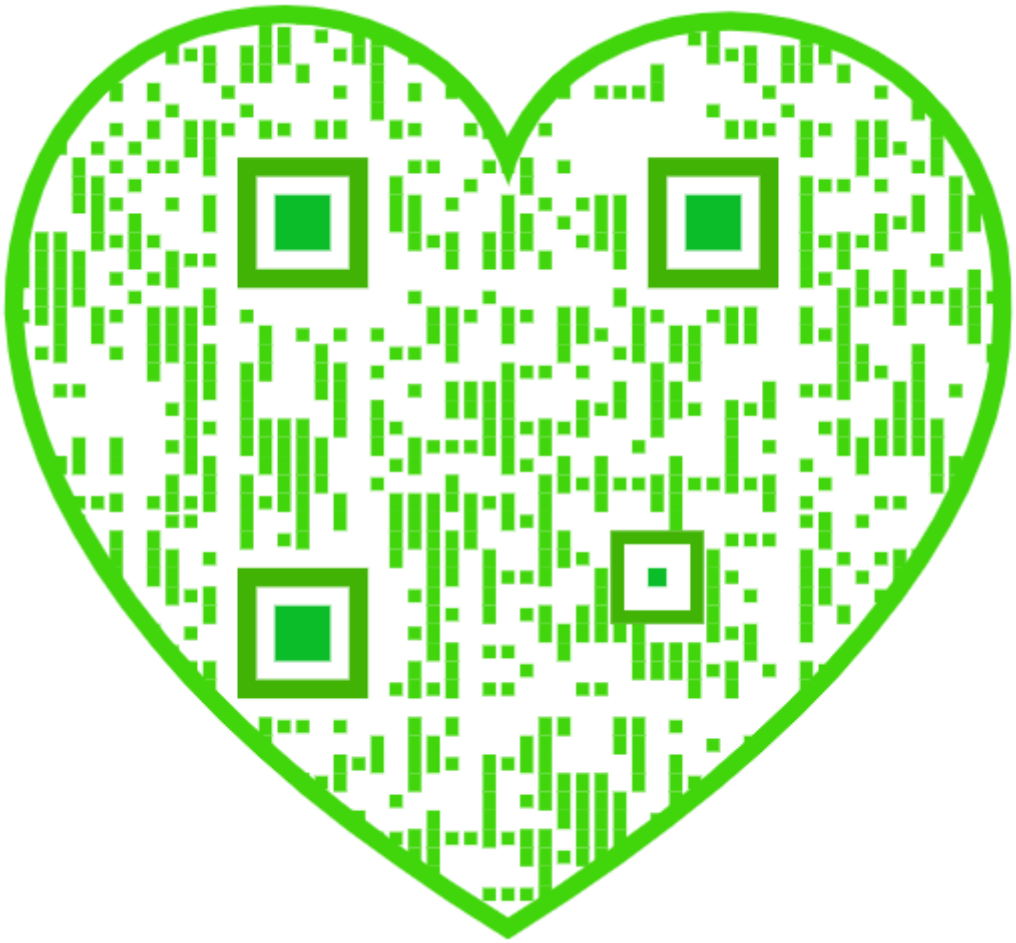

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Town Scavenging and Refuse Disposal

By Hugh S. Watson, A. M. I. C. E., London, England

Utilization of Residuals from Refuse Destructors.

THE utilization of the residuals from refuse destructors is a matter which has lately been attracting considerable attention. It will generally be granted that refuse destructors are capable of destroying refuse so as to render the resultant residuals perfectly harmless to health, and that a certain amount of steam can be produced in the process. The residuals, however, which amount to about 33 per cent. of the total refuse dealt with in the destructor, have got to be disposed of, and if they cannot be utilized their disposal may add considerably to the cost of working the destructors. The residuals consist mainly of clinker and fine ashes, the exact composition depending entirely upon the nature of the refuse. In some instances this can be sold direct to builders for use as concrete or mortar, or as a foundation for roads, etc. In others there is only a demand for it after it has been broken and screened to different grades. In London considerable difficulty is experienced in disposing of it at all, owing to the stringent by-laws of the County Council. Various methods have been tried to utilize the clinker by the manufacture of paving stones, bricks and mortar. Their production has, in many cases, been successfully accomplished, but even then the difficulty of finding a market for them has to be faced, as, although they can generally be produced at a cost below that of natural stone, they are not so durable.

Mr. A. May, cleansing superintendent of the Metropolitan Borough of Finsbury, has found that they are quite unsuitable for the heavy traffic in his district, and thousands of square yards had to be taken up after they had only been laid two years. On the other hand, Mr. H. Percy Boulnois, in a paper read before the Royal Sanitary Institute, referring to the bricks manufactured from the destructor clinker of the Metropolitan Borough of Fulham, stated that they did not command a very ready sale, "as they are very hard to break, and the bricklayers find them rather harsh to handle and impossible to break with the usual blow from the trowel." The processes of slab making that have been adopted in various towns differ somewhat, both as to the mode of manufacture and the composition of the stones produced. This may possibly account for the varying results which have been experienced in different towns, but of course the nature of the traffic to which they will be subjected must be taken into consideration. In order to show what has been done up to the present in the way of utilizing destructor residuals the author proposes to describe several processes which are in operation in England.

Clinker Grinding at the Kidacre Street Works of the Corporation of Leeds.—The clinker removed from the destructors in Leeds is ground to about one-quarter inch in size, and is used by the Tramways Department for sanding the rails in greasy weather. Mr. Mann, the cleansing superintendent, states that it is more effective than sand. The price paid by the Tramway Department to the Public Health Department is two shillings per cubic yard. The quantity used is so great that the supply barely equals the demand, notwithstanding that all the clinker produced during dry weather is stored until required.

The clinker is first passed through a stone-breaker, after which it is ground in a crushing pan 7 feet in diameter. After passing from the crushing pan it is raised by a continuous chain elevator, sifted on special screens and conveyed into hoppers, from which it is delivered to the carts, which are drawn up underneath.

Clinker Grinding at the Metropolitan Borough of Fulham's Destructor Works.—A certain amount of the clinker produced at these works is used for the manufacture of slabs and bricks, but there is a good deal of surplus material, which is disposed of to builders for the manufacture of concrete and mortar. The clinker is first passed into a granulator, on passing from which it is conveyed in an endless chain conveyor to a magnetic separator. This machine is designed to extract any nails or small pieces of iron or steel there may be in the clinker, as by so doing it is made more suitable for building purposes, and consequently has a higher marketable value. The magnetic separator consists of an inclined revolving cylinder, having magnets placed along its length at intervals. The magnets are excited by a dynamo. A trough is placed inside the cylinder, running the full length, but it is not connected with it in any way. The clinker is fed into the cylinder at one end, and, as the clinker revolves, slowly makes its way out at the other. Any nails or pieces of iron, etc., are picked up by the magnets, which break contact every time they come round to the top, thereby dropping any metals they may have picked up into the trough, from which they are emptied into barrows and removed. The clinker on passing from the separator is conveyed to a mechanical sifter. This consists of a long trough, having a perforated bottom composed of zinc sheets. The perforations are of three sizes, the smallest being those nearest the feeding end of the machine. The trough is worked rapidly backwards and forwards by means of a cam revolving at high speed. Under the trough are placed three hoppers, into which the different sizes of material fall, all that is too large to pass through any of the perforations making its way to the end of the trough. The hoppers are provided with doors in the bottom and are placed at such a height that carts can be drawn up underneath and filled direct. The clinker is sold at one shilling and sixpence per cubic yard at the works.

Screening by Hand at the Destructor Works of the Metropolitan Borough of Hampstead.—The clinker is laid out on the ground and crushed by men using punners. The crushed clinker is then passed through a revolving screen, which is worked by hand. The screen has three sizes of mesh, and the clinker which passes through the two larger sizes is sold at one shilling per cart load, while that which passes through the finest realizes about eight pence per load.

Flag Making at the Destructor Works of the Ealing Corporation.—The clinker is placed on the ground in a layer about fifteen inches deep and a steam roller is run over it in order to crush it. It is then screened in coarse screens, and any tins or pieces of under-burnt material are removed. The clinker retained on the sieves is used for filling the contact beds or filters at the corporation's sewage purification works, which adjoin the refuse destructors. The material that passes through the sieves is screened a second time to remove the dust, after which it is utilized for the manufacture of paving slabs in the following manner: Three parts of clinker, one part of cement and a sufficient quantity of fine dust from the combustion chamber of the destructors to fill the interstices (about 1 in 8) are mixed with a small proportion of water in a revolving mixer. When the mixture has become thoroughly incorporated a sufficient quantity to form one slab is placed in the die of the pressing machine. The die is of soft steel, but a piece of zinc is placed on the bottom before the concrete is put into it, partly to give the slabs a smooth face and partly to prevent them adhering to the die. A sheet of perforated zinc is also placed on the top, and a piece of coarse canvas laid on this. The die is then put into the press and a pressure of 2,000 pounds per square inch is brought to bear on it. The die remains in the press for about one and a half minutes, when it is taken out and the concrete slab is removed and placed on one side under cover for about a week so as to get thoroughly hard. They are then stacked in the open for about six months so that they may mature. The slabs are made in sizes of 2 by 2 feet, 2 by 2.5 feet and 2 by 3 feet, and they are about 3 inches in thickness. They can be made at the rate of about 20 per hour when the clinker has been already prepared. The cost of producing the slabs is from one shilling and nine pence to two shillings per yard super, inclusive of labor, materials and depreciation of plant.

Flag and Brick Making at the Destructor Works of the Metropolitan Borough of Fulham.—The processes of slab and brick making are carried out as follows: The clinker is shoveled into a feeding trough, which conveys it to a granulator. After passing from the granulator it is raised in a conveyor, consisting of an endless chain having a number of small buckets at-

tached, to a mixing mill, where the cement is added and the whole thoroughly incorporated. The proportions used are, for the manufacture of bricks, 9 to 1, and for the manufacture of slabs, 3 to 1. The correct proportions are obtained by having the cement placed in a gauging box alongside the mill, a small amount being added after every certain number of buckets have been emptied into the mill; the exact number required to give a cubic yard being known. Water is added to the clinker and cement in the mill. For brick-making a very stiff mixture is used, but for slab-making the mixture must flow easily. The granulator and mixing mill are belt-driven machines, the power required being obtained from an engine supplied with steam from the three-mold machine made by Messrs. Fielding & Platt, Ltd., of Gloucester. The molds are placed on rests attached to a central pivot, which is revolved by means of a ram. The mixture is first run into the mold on rest A. This is then moved into position B and the hydraulic pressure applied. The mold is then shifted to position C, where a vacuum plate is attached to the top of the slab, which lifts it out of the mold. The action of the vacuum plates is shown in Figures Nos. 1, 2 and 3. The plate is suspended from an overhead crane by means of the chains D D. When it is wished to remove a slab the ram is forced upwards against the discharge plate A until the slab B comes in contact with the plate C. This plate has a tube, E, which is connected to a

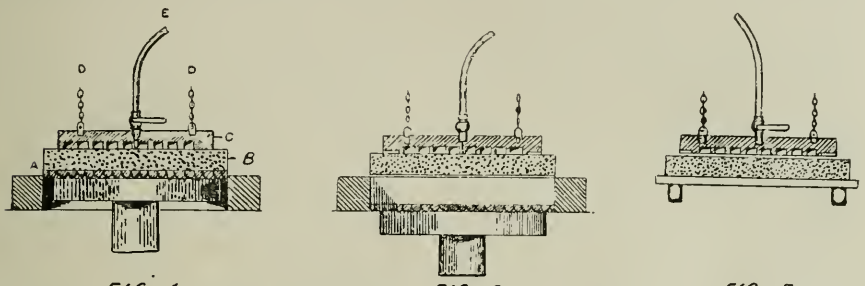


FIG. 1 FIG. 2 FIG. 3

VACUUM LIFT FOR ARTIFICIAL PAVING SLABS.

destructor boilers. The mixture is drawn from the mill down one or the other of two chutes, which convey it either to the brick or slab-pressing machine. These machines are worked by hydraulic pressure, supplied from an accumulator, the total pressure required for brick-making being 60 tons and for slab-making 400 tons, the whole of which is concentrated on the slab.

The brick-making machine is by Messrs. K. Whittaker & Co., Ltd., of Accrington. The bricks are made in molds; these are run under the chute leading from the mixing mill, filled with the mixture, scraped flush and then run into the machine entirely by hydraulic pressure. The molds are moved backwards and forwards automatically by means of a revolving cam. The bricks weigh about 5 lbs. 14 oz. each, and they absorb only about 6 per cent. of their weight of water. They are very hard, and have a greyish blue color, somewhat resembling Staffordshire blue bricks. They can be produced at the rate of nine per minute, and the cost of manufacture is about £1 per 1,000. The slabs are made in a vessel in which a partial vacuum is always maintained. The result is that as soon as a cock is opened a partial vacuum is created over the whole of the surface of the plate in contact with the slab, which is sufficient to hold it. Figure 2 shows the ram back in its first position and the slab being held by the vacuum plate. As soon as the slab has been placed on the trolley on which it is to be removed the cock connecting the vacuum vessel with the plate is closed and air is readmitted to the channel spaces, thereby releasing the slab. This system of lifting avoids all handling of the slabs, so that there is no risk of damaging them while still green. The molds in which the slabs are made consist of wooden frames, with a perforated steel top, the perforations being 3/32 of an inch in size on the inside and ¾ of an inch on the outside. A piece of brown paper is laid on the bottom of the molds to prevent the slab adhering to the zinc; this is removed previous to the slab being deposited on the trolley. The slabs are kept in the open from three to six months, so that they may ma-

ture before being used. The following sizes of slabs are made: 3 ft. by 2 ft., 2 ft. 6 in, by 2 ft., and 2 ft. by 2 ft.; they are 2¼ inches in thickness. They can be made at the rate of 8,000 per day, and the labor required is as follows:

One man to shovel the clinker into the granulator; a boy to attend to the mixing mill; one man to superintend the filling of the molds and to apply the hydraulic pressure; two boys to remove the finished slabs, and a general foreman to superintend the whole of the operations.

The slabs cost about 2 shillings 8 pence (65 cents) per square yard to produce and sell readily at 3 shillings (75 cents) per square yard.

Sewage and Refuse Disposal in Memphis, Tenn.

THE city of Memphis, Tenn., is located on a bluff nearly 50 feet above high water in the Mississippi river and nearly 90 feet above low water. Back of the bluff is the Bayou Gayoso, which flows through the city for some 15 miles and provides a natural outlet for street drainage but not for sewage. Branches of this bayou drain most of the city. The sonth city line is near the summit of the bayou's watershed, and that stream flows north nearly the whole length of the city and discharges into Wolf river, which, in turn, discharges into the Mississippi river, which flows in a southerly direction in front of the city. Some of the city in the vicinity of the outlet of the bayou is below the level of high water in the river. Less than 200 acres of this low land, aside from that included in the bayou itself, is behind the levee which has been constructed to keep out the river water.

The sewers of the city were constructed according to the separate system. The "Early History of Sewers of Memphis" is told in an article by a former city engineer in MUNICIPAL ENGINEERING, vol. xxxvii, p. 232.

The surface water gathers on the streets and is carried to the nearest branch of the Bayou Gayoso, or to the bayou itself. The outer districts to the south and east drain into other streams. Some of the methods of treating the storm drainage problem at street intersections are shown in an article by J. H. Weatherford, the present city engineer, in vol. xxxvii, p. 374. These methods are not everywhere satisfactory and some storm water sewers will doubtless be constructed before long, particularly for the service of the heavily traveled streets on which foot traffic is at time seriously impeded by the rush of water or the gathering of water faster than it can get away.

During ordinary stages of water the sewage from the sanitary system runs into the river through the 48-inch outlet directly into Wolf creek near its mouth. When the water in the river rises 28 feet above datum, which is near low water, this outlet is closed by a gate and then the sewage has heretofore run through a 36-inch pipe to a pumping station located close to the Bayou Gayoso. It may here be turned into the bayou behind the levee, may be pumped into Wolf creek or may be turned into a relief reservoir on one side of which the pumping station is located. This reservoir is 105 by 150 feet, approximately, in horizontal dimensions and has a wall 5 feet high. The banks extend 10 feet higher, so that, if necessary, something like 15 feet depth of water could be carried in the reservoir.

Should it rain on the bayou watershed while the river is over 28 feet above low water, the pumps in the pumping station are started so that the low ground behind the levee will not be flooded.

The pumping station and reservoir are also designed to take care of the flow from two storm water sewers, delivering directly to the pump pit, one of which from the south and west sides of the bayou is 36 inches and one from the north and east sides 30 inches in diameter.

The station is equipped with two large horizontal centrifugal pumps. One 20-inch pump is operated by a 150-h. p., a. c. motor, 60 cycle, 2,200 volt. The other 24-inch pump has a 175-h. p. motor. There is also an 8-inch vertical centrifugal pump, with a 40-h. p. motor. The bayou gates are closed when the water in the river reaches 28 feet, and the pumps are started as soon as it rains hard and the storm water begins to raise the water behind the levee. When high water reaches 34 feet the pumps are kept going so as to give some leeway in case of a heavy local rain. The pumps are ordinarily put in use about twice a year. Occasionally high water lasts several

months and during such times the pumps must be started whenever it rains.

A new pumping station was recently completed which is located on the 48-inch outlet sewer, or rather on a lot abutting on the street in which this sewer is laid. This station will take care of the discharge from the sanitary sewer system, so that, except in case of accident, it will not be necessary to turn the sewage over to the bayou or the reservoir at the old pumping station to be taken care of with the flood water.

A gate in the 48-inch sewer is closed when the water in the river reaches about 28 feet and the pump is started, taking the sewage out of a pump-pit connected with the sewer above the gate, and discharging it into the sewer on the river side of the gate. By using a by-pass on the old branch to the old pumping station the pumping at the new station can be reduced, if necessary or desirable, to the days of heavy rainfall and the river above 28 feet.

The pump pit at the new station was sunk by the use of a boiler-plate cutting edge on a caisson of 18 feet inside diameter. This was settled by excavating round the caisson and building a concrete wall on top, which gradually settled the well casing to place. The bottom of the pump pit is 22 feet below the floor level. The machinery at present installed is a 20-inch centrifugal pump, with 24-inch discharge, operated by a 150-h. p. 200-volt, 3-phase, 60-cycle motor, supplied by the Dayton Hydraulic Co., Dayton, O. The regular design of the pump made by this company was somewhat modified to suit the work to be done. The small building housing the machinery is of concrete—walls, floor and roof—and is large enough for duplication of the machinery.

In its treatment of garbage and refuse the city of Memphis differs but little from other cities. There are in regular service 60 garbage carts, each drawn by a mule and operated by a colored man. There are 75 carts that can be put into service when necessary. There are also a paper wagon and a paper cart in regular service which pick up dry refuse which is not too heavy. Ashes are also collected and used for filling. Ordinarily from 90 to 110 cart loads of garbage are collected each day and about the same amount of ashes are collected during a part of the day by the same carts.

The garbage collection and disposal are under the board of health, and in close connection is the street sprinkling department, which operates from 45 to 50 sprinkling carts, each drawn by 2 mules and operated by a colored man.

The garbage destructor is an old Dixon furnace which has been reconstructed and modified until it is quite different from the original plant. It is located in a thickly populated district and, to judge from the day of the writer's visit, is operated practically without nuisance. The combustion of the garbage requires the help of two or three tons of coal a day, which is increased to four tons during the watermelon season, on account of the great amount of moisture in the garbage from watermelon and other fruit refuse.

The cost of operating the system of garbage collection and disposal, including pay-roll and feed for mules for both garbage carts and sprinkling carts, is about $3,000 a month. About 100 mules are required for the sprinkling carts and 75 for garbage carts. The garbage crematory requires one fireman and four burners, three day and two night watchmen, besides the cart men. There are two plants, and besides the stable boss at each stable there are at each two stable men.

The cart .men receive $1.50 a day, firemen $2.

The class of labor employed is not of high efficiency and it is not possible with the small supervising force which the funds of the board can employ to educate them to neatness or thorough cleanliness. There is little connected effort to educate householders to their duties.

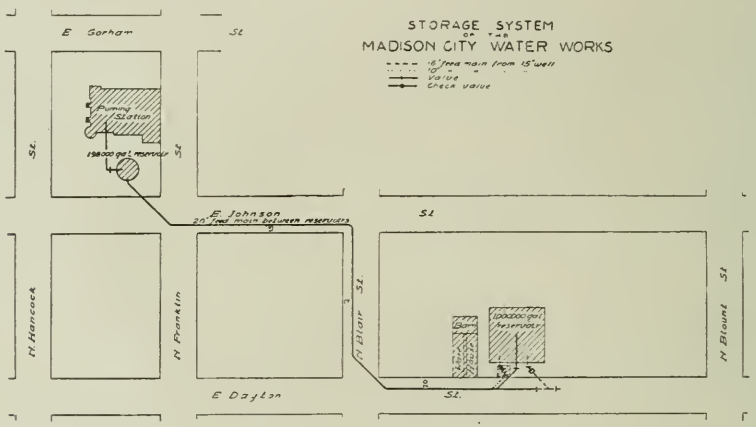
The results obtained as to lack of nuisance in collecting and destroying refuse and as to condition of back yards and alleys are quite commendable under the present handicaps.

The stables are located about the garbage furnace and are kept in very fair condition. They are quite as objectionable in a neighborhood as the garbage furnace and might easily become much more so. In fact, there is little or nothing about the crematory to object to, what complaint there may be under ordinary conditions being based on the numerous loads of garbage hauled through the streets rather than on any emanations from the plant.

The Water Works of Madison, Wis.

By Ralph Birchard, Madison, Wis.

FEW cities in the world have a better quality of water supply than that which is taken from the deep wells at Madison, Wisconsin. These wells tap the artesian reservoir in the Potsdam sandstone at a depth of about 750 feet. The water rises in them to within about 60 feet of the surface. It contains no organic matter and only enough calcium and magnesium carbonates to make it thoroughly palatable. Its analysis corresponds rather closely to that of the water from the famous Bethesda spring at Waukesha.



The water is furnished to the city through 58 miles of mains varying in size from 3 to 16 inches. The average daily pumpage at present is 1,700,000 gallons, or 56 gallons per capita of Madison's 30,000 population. Pressure in the mains varies from 40 to 85 pounds per square inch. The pressure at the central pumping station is 125 pounds. A small standpipe near the center of the city acts as a pressure equalizer on the mains radiating from it.

All the water is pumped through an Allis-Chalmers triple-expansion vertical pump, which has a capacity of 3,000,000 gallons. At the time of the original installation in 1883 the few wells in the central station supplied enough water for the city. As the demand has increased it has been found necessary to sink new wells. There are now 10 in all. These wells must be spaced at least half a block apart to give full flow. Because they have been placed at some distance from the central pumping station, the system of having an auxiliary pump at each well has been adopted.

Three wells are now equipped with smaller deep-well pumps, operated by electric motors. Two of these are P. K. Wood propeller pumps, 7 and 8 inches, respectively, in diameter, while the third is a Byron Jackson 9-inch centrifugal. These pumps lift the water about 75 feet and supply the feed reservoirs, which are drawn upon by the large pump. Two reservoirs are in use. One, on the central station grounds, has a capacity of 198,000 gallons, and the other, about 3 blocks away, will hold 1,000,000 gallons. They are connected by a 20-inch main, so that the water stands at the same level in both, the float gauge on the small reservoir indicating the amount of water on hand at any time. The deep well pumps supply about 800,000 gallons per day, or nearly one-half of the total quantity. The remaining part of the daily pumpage is drawn direct from wells by the large pump at the central station.

Current to operate the deep-well pumps is generated at the central station. A simple engine, which formerly formed part of a Reynolds-Knowles-Corliss pump, is connected to a Northern Electric Company 100 k. w., d. c. generator. Current is supplied to the motors at 550 volts pressure.

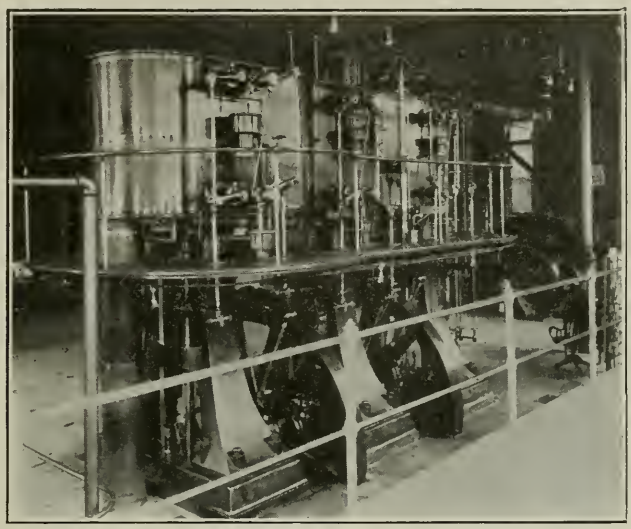
Under ordinary conditions of service

only two deep-well pumps are in operation at the same time. These will lift 80,000 gallons per hour into the reservoirs, placing a load of 100 h. p. on the engine. The coal consumption of this engine is very high, 3½ pounds per h. p. hour. The coal used is anthracite pea, now being furnished at $7.10 per ton. Fuel is the largest item in the cost of the deep-well pumping. The cost of firing the boilers remains the same whether the engine is running or not. One man is required at each pump and paid at the rate of 20 cents an hour. The cost of the deep-well pumping at the rate of 80,000 gallons per hour is, then:

350 lbs. of coal at $7.10 per ton	$1 24
Attendance	40
Oil, waste and repairs	20
Total	$1 84

Or 2.3 cents per thousand gallons.

The total cost of pumping for the year 1908-09, including maintenance and repairs, was $0.0425. From this it appears that half the cost of the water pumped in two stages came in the operation of the deep-well pumps. The cost of pumping has been slightly higher in the last few years since the deep-well pumps were installed. The table below shows the cost of pumping in cents per thousand gallons. The cost of fuel has been taken at $7.10 per ton in all years in order to secure a true comparison between past and present conditions. Although the cost of pumping does seem to have increased slightly, it is probably far less than what it would be if the attempt were made to pump directly from all the wells. In fact, with the present machinery, this method would be out of the question, as the supply secured that way would not equal the present demand.



MADISON, WIS., WATER PUMPING STATION.

Main Pumping Engine In Foreground. Dynamo Furnishing Power for Electric Deep-Well Pumps In Right Background. Indicator of Water In Reservoirs on Wall at Right of Main Engine.

Year	Pumpage in Millions of Gallons	Fuel Used Tons	Duty in Gals. per lb. of Coal	Total Expense	Cost per 1000 Gals. Cents
1890-91	198	522	190	$ 9,733	.0491
1895-96	325	779	209	16,046	.0493
1900-01	358	788	227	13,756	.0383
1902-03	420	774	272	18,177	.0432
1904-05	537	912	294	18,436	.0343
1906-07	531	1,103	240	21,220	.0399
1907-08	570	1,315	217	28,056	.0492
1908-09	617	1,685	184	26,177	.0425

It is evident that the coal used in generating electricity produces a much smaller result in lifting water than when used directly in the large pump, but probably not as small a result as if the steam pump were lifting water from wells some distance from the central station.

A large item in water consumption in Madison is the amount used for

street sprinkling, sewage dilution and fire protection. For these purposes the water could well be taken from Lake Mendota. The proposition of laying a parallel system of mains through the downtown district, filled with a separate circulation of lake water is now under consideration by the Board of Water Commissioners.

The meter system of water rates is used by 99 per cent. of Madison's 4,601 paying water-takers. The rates in force are:

Three thousand cubic feet or less, per year, $4.00; next 5,000 cubic feet, 13c per hundred cubic feet; next 15,000 cubic feet, 10c per hundred cubic feet; all over this amount, 5c per hundred cubic feet; minimum charge, per year, $4.00.

The average income per meter installed in Madison was $8.93 last year. A few takers still use the schedule basis, where a minimum charge of $5.00 per year is made.

The work of laying water mains has been carried on with marked economy in Madison through the use of the trench-excavating and pipe-laying machine designed by Mr. John B. Heim, superintendent of the water works. This machine was described by Mr. Heim in MUNICIPAL ENGINEERING for June, 1909.

The Young Engineer and His Working Tools

By Charles Lyon Wood, C. E., Columbus, Miss.

THE various technical schools throughout the country are turnout their quota of graduate engineers. Fortunate indeed is the student who has been able to spend his vacations in actual work as axeman, chainman or rodman with some engineering party and thus learned the rudiments of the profession at first hand, and fortunate is he also who, having had nothing during his college course but picnic surveys and campus practice, has the common sense to leave his diploma in his trunk and solicit a job as axeman, chainman or rodman. It is better to go up than down, and in order to stay up one must know every step of the trail.

Not all graduates will get positions, and of the positions secured many will be temporary, and so the young engineer will need to get together an outfit as early as possible and engage in private practice "between jobs" at least, taking whatever work comes his way, running land lines, terraces and drainage ditches for farmers, sidewalk levels, etc. To this class of beginners the following suggestions as to field and office equipment and use of the same are offered by one who has "done the don'ts" therein mentioned. The lists of instruments and books named are believed to contain no "junk":

One transit, standard make, 4½-inch needle, variation plate, fixed stadia clamp and level on telescope, split-leg tripod, leather-covered box with carry straps.

One 18-inch Y-level, cloth finish, split-leg tripod.

Two ranging poles, preferably wood.

One ranging pole, take down, for easy carrying on trains, etc.

One 100-foot steel tape.

One 50-inch pocket tape, steel or copper-woven.

One level rod.

One brazed link gunter's chain, 66 foot. (Pocket compass and hand level.) Get transit tripods interchangeable. This will reduce the travel load when there is only one operator for both instruments.

As to transit and level, each engineer has his opinion, usually based upon the make with which he is most familiar. Personally I prefer a Young or Bausch & Lomb transit and a Young or Gurley level. The young engineer should be careful in his first purchases, for an unsatisfactory instrument is practically unsalable, except at a tithe of its cost, and a few dollars may represent the difference between an instrument good for a lifetime and one that you expect to use for "just a while."

The young practitioner is usually short of funds, hence the temptation to buy cheap goods or second-hand goods. Beware of second-hand instruments. No matter how carefully a damaged machine may be repaired, it is not quite the same as before. This is not to say, on the other hand, that every new instrument is up to requirements. Many are failures from the factory and each should be subject to a thorough trying out in the field by an experienced engineer.

An instrument once bought should be well taken care of. When not in use it should be kept in case out of the

dust. The transit needle should be clamped up when carrying the instrument from place to place and immediately released when at rest. A 4½-inch needle is much more sensitive than a 6-inch.

Do not allow idlers to "monkey" with your machine. The best way to carry an instrument when traveling by conveyance or train is on your lap, and in this case a canvas or rubber drawstring bag should cover the instrument. In case of wreck, save the machine. The writer remembers a railway wreck when he was thrown out of the caboose, but instinctively and in spite of skinned arms, kept the transit out of harm.

The young engineer should be able to make the necessary instrument adjustments quickly and accurately, but he should realize that he can reduce largely the amount of "tinkering" required by careful handling of his instrument, and he should be certain also that the instrument is really out of adjustment before he attempts to tinker at all. He should likewise know when to let "good enough alone," for an instrument in approximate adjustment and handled as though it were out, applying the checks of reversal and double shots, will insure better results than if the operator adjusts to a "hair nicety" and then goes on faith in his achievement.

A common source of error in transit work is the neglect of the operator to get a proper focus on his ranging rod, and for this reason the instrumental focus should not be "strained" by excessively long shots, two sights of 1,000 feet are usually better than one of 2,000 feet. In ordinary level work the chief sources of error are two: Refraction of air and error in reading the rod. It is assumed that the leveler reads his own rod, and does not follow the antiquated method of the books. The sole duties of the rodman are to set the rod, call the station number and cut bench marks.

A good general purpose steel tape is required. Keep the kinks out of this tape and it is practically unbreakable. Drays and wagons have no effect upon it. A vest-pocket repair kit for 25c of one maker does its work as well as any $5.00 outfit of my knowledge.

For land surveying a 66-foot tape or brazed link chain is much preferable to the 100-foot railroad tape (the Gunter's chain is the unit of land measure), as its use will save a vast amount of figuring in computing areas. I prefer to have two chains attached by a snap for long measures. Green hands can use the 66-foot chain on land surveys much more readily and keep count more accurately than they can the 100-foot tape, and the young engineer can count on his share of "greenies." Often he will have to make surveys when he himself is practically the corps and his day's work will depend on his individual energy and ingenuity. Once I made a land survey with a party composed of Choctaw Indians who could not speak a word of English. On another occasion I set out a curve for a street car line with only one helper.

Other instruments used on surveys are the plane table, solar compass and theodolite, but these are usually furnished by the employer.

After the survey comes the office work, and this leads us to the tools on the drafting table and the table itself.

Drafting tables are of two kinds—stationary or portable. They are also, as to top, flat or tilting, the one thing of importance being that the top shall have a true working surface, free from knots and hard grain, and that it sets squarely upon the logs or benches. Nothing is more conducive to profanity and poor work on the part of the draftsman than a weak, springy top set on rickety benches. White pine makes the best table top, next in order red gum and cypress, and two inches is about the right thickness for office use. Any good carpenter can make a good drafting table if you will tell him how and watch him all the time. If the material used is red gum or cypress, it should be cut into strips 1x2 inches and length of table wanted, thoroughly kiln dried, set edgewise and built up on counter-sunk battens, working from the middle each way, and the surface dressed to line. A top so built will not shrink or warp, and can be mounted on any style of support desired. I prefer ordinary trestle benches.

The table should be provided with a drawer underneath as long as the table is wide and pulling from each side. It will be found very convenient to have a long table, say 4½ by 8 feet, and a separate top about 3 feet by 4 feet, which may be rested on the larger and used for small drawings.

The following list will include the drafting instruments needed by the young engineer in general practice, and here the same precept holds good as with the field instruments. "Buy only what you actually need, and get that good." No brass.

One straight line pen, large.
One straight line pen, small.
One R. R. pen, double line.

One compasses, pen and pencil points and lengthening bar.
One bow pen, with pen and pencil points.
One bow spacer.
One spring dividers.
One steel triangle, 10-inch, 45x45x90 degrees.
Two zylonite triangles, 30x60x90 degrees, and 45x45x90 degrees.
One straight edge, steel or wood, 42 inches.
One straight edge, steel or wood, 24 inches.
One triangular scale, 12-inch, boxwood, with white edges.
One beam compass.
One half-circle brass protractor.
One 3-minute vernier protractor.
Two irregular curves.
One adjustable curve.
Nest of railroad curves, difference 30 minutes from 1 degree to 10 degrees; three-inch tangent, steel eraser, thumb tacks, rubber erasers.
One dozen Kohinoor pencils—2H, 3H, 4H, 6H.
Assorted inks.
Brushes.

Finally we come to the very thing the embryonic engineer started with, books. What does he need? What sort of an office library shall he build up? What of his college texts is worth a place in it? Here the same rule applies as to instruments except more so, for engineering books become obsolete much more quickly than do engineering instruments. The rapid advances in all branches of engineering make the authority of today a back number tomorrow. (This does not apply to logarithms and trigonometric formulæ. One is safe in buying these.) I have among my "curios" a text on Railway Engineering written a good many years ago by one of our foremost professors and sold largely in advance at $25.00 per volume. I bought my copy from a fellow practitioner for $3.50, but I did not gain that worth of information from it, and I doubt if there is a single thing in the book that applies to railroad engineering and management of today. The young engineer should go slow on encyclopedias of the "exhaustive" type—exhaustive of purse rather than subject, they will prove to him. He should read the engineering current literature such as *Engineering News*. MUNICIPAL ENGINEERING. *Engineering-Contracting*, and cull from these materials for a line of scrapbooks. A well-indexed scrap-book is very valuable, for it carries a touch of individuality. The compiler is an author in spirit. He can in addition profitably invest in the following list of books:

Butts' Field Engineering (pocket book).
Trautwine's Pocket Book.
Webb's Railroad Construction, Theory and Practice.
Turneaure-Russell: Public Water Supplies.
McCullough's Engineering Work in Towns and Small Cities.
Johnson's Surveying.
Molitor & Beard's Manual for Resident Engineers.
Gillette's Handbook of Cost Data.
Reinhardt's Lettering.
Elliot's Engineering for Land Drainage.

Making a Stream Excavate Its Own Reservoir and Build Its Own Dam

By Burt A. Heinly, Los Angeles, Cal.

MOTHER NATURE is a kind old soul if she is handled in the right manner, and it is the faculty of the successful engineer to treat her kindly and favor her moods, but always to his own advantage. Here is an instance of how a stream was made to excavate dirt and stones, carry the debris more than half a mile to a dam site, deposit it in an impenetrable mass across a little canyon and in the end to impound the stream flow to form a lake three-quarters of a mile long, half a mile wide and more than fifty feet deep.

The methods used were those of the hydraulic filled dam—a plan of construction which, through its cheapness, practicability and the satisfactory results attained, has gained great popularity in the West since the first experiments, which were made only a few years ago. In fact, it is only an adaptation of sluicing as it is used in placer mining.

The city of Los Angeles required larger and more storage reservoirs to guard itself against the danger of a water famine during the hot, dry summers. William Mulholland, the city's

water superintendent, sought a reservoir location and after finding a site a mile from the Los Angeles river, which is the city's source of supply, he set about the construction of a dam. Before the structure was completed he had made recourse to a number of novel engineering features.

In the first place it was necessary to bring the water to the depression in the hills in order that the precious fluid might be placed at work to the best advantage. This was accomplished by the construction of a concrete conduit and half a mile of tunnel. In the meantime, while this was being done, a force of men were at work at the lower end of the valley. To shut off any percolation underneath the dam a trench 20 feet wide was excavated 30 feet to bed rock and a steel curtain, imbedded in concrete, was carried to a height of three or four feet above the original surface in the center of the valley.

In this way a small construction reservoir was built and as soon as the water was turned into the valley Mr. Mulholland was ready to place it at work. How large a task was set before Mother Nature may be seen from the fact that the Silver Lake dam as it stands today contains 146,000 cubic yards of earth, is 900 feet along the crest, 56 feet high and impounds 273,000,000 gallons of water for the city's needs.

A force pump was rigged up and to this were attached lines of fire hose and nozzles. Under a pressure from 60 to 100 pounds per square inch these hydraulic jets, as shown in the illustration, excavated the earth, which, dissolved by the water into a semi-liquefied mass, flowed slowly down the slope to a sump. Here a small centrifugal pump had been prepared to take care of it. As the earth and water were sucked into the pump they were as quickly projected out of it through a line of eight-inch steel casing to the dam site half a mile away.

On each side of the dam site embankments from three to four feet in height had been raised to retain the liquefied mass and as the dam continued to increase in altitude these slight embankments of soil were kept always several feet above its surface.

The earth and water flowed slowly along between the two banks and solidified into a solid mass for two reasons: First, because of evaporation under the hot California sun, and, secondly, because Mr. Mulholland played a neat little trick. Naturally, at the end where the liquified mass first entered the dam

SILVER LAKE RESERVOIR, LOS ANGELES WATER SUPPLY.
Hydraulic Fill Dam on Left.

the elevation was always highest. So at the other end, whatever water reached there was drawn off into the constantly enlarging reservoir and so made to work over and over again.

The water carrying its burden of dissolved earth, was guided along the inside of the earth walls before described by flumes and lateral branch pipes. As the mass moved the more slowly the heavier particles and the sand were deposited first, but the finer particles of clay, being nearer in solution, were the last to be precipitated and so were carried to the very middle of the dam, where, as the work progressed, Nature built a strong semi-metallic wall at the point where the greatest strength in a dam is needful, namely, along the middle of the structure. And while the dam extended itself outward and upward the hydraulic jets continued to increase the area of excavation and so increased the capacity of the reservoir.

The dam was approximately nine months in building, cost $55,000, where by adopting the old-time methods it would have cost twice that amount, and served a most useful purpose in view of the fact that the many lessons learned are soon to be applied to the construction of the earthen dam of the great Haiwee reservoir, one of the impounding basins of the Los Angeles aqueduct system, hitherto described in these pages.

That the hydraulic method is a safe one is shown by the fact that no leakage or fault has developed since the construction of the Silver Lake dam two years ago, and that it is practical and simple is demonstrated by the equipment gotten together. This consisted of the odds and ends usually to be found about a water system and not more than $200 for new material was required in the whole course of the work.

To illustrate that it pays for an engineer to be practical: Here is another example of the same principle, in which Mr. Mulholland is making a stream clean a reservoir which it had partially filled with silt. In January of this year it became necessary to make changes in the outlet of the Buena Vista reservoir, which has a capacity of 13,000,000 gallons, and it was emptied for the first time in fifteen years. Considerable silt deposits several feet in depth were found. These are now being cleared away by the use of the same principle, but with a reversal of the method. The silt banks within the reservoir are made into a soil saturated solution by the hydraulic jets playing upon them, are carried by the water to an outlet and washed through it into the river bottom.

SILVER LAKE RESERVOIR, LOS ANGELES WATER SUPPLY.

Hydraulic Fill Dam Under Construction. Silt-Bearing Water Between Embankments Which Are Raised By Shovels as Deposit Increases In Center.

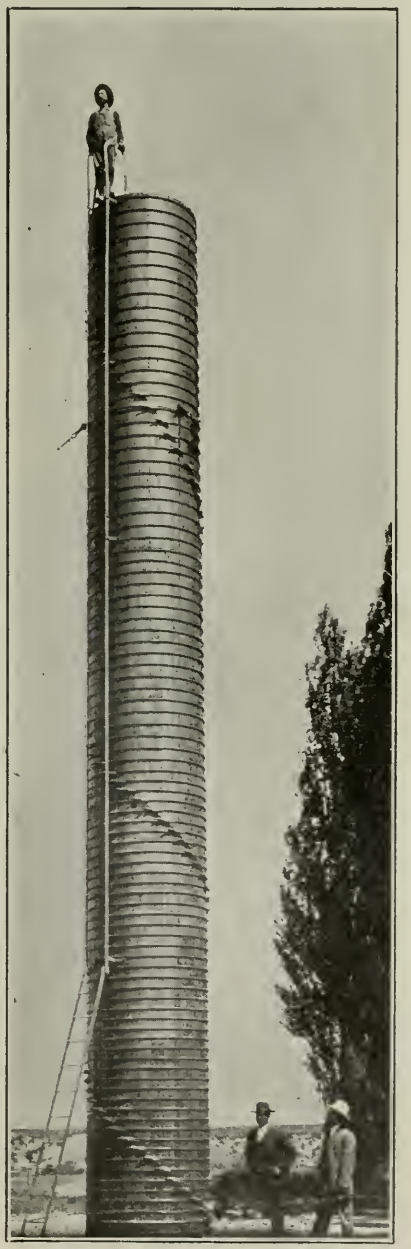
Machine-Banded Continuous-Stave Wood Water Pipe

By Frank C. Perkins, Buffalo, N. Y.

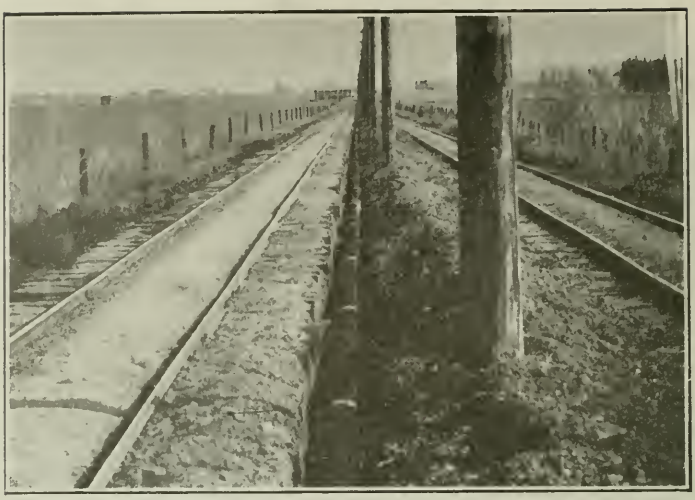
DURING the past decade many installations of wood water pipes have been put in throughout the West for city service, for irrigation and for hydro-electric power systems, as well as for stand-pipe service. An example of the latter use of wood water pipe is indicated in illustration, Fig. 1, which shows a stand pipe erected for the city water system of Walla Walla, Wash. This stand pipe was constructed 64 inches in diameter and to a height of 46 feet. It was made of continuous stave pipe and is used as a pressure regulator, there being an overflow pipe inside of the stand pipe. One of the advantages of wood pipe over cast iron or steel is that it is not affected by electrolysis and it is therefore of value when a pipe line must be installed near an extensive electric railway system. The accompanying illustration, Fig. 2, shows a 64-inch machine-banded redwood pipe which operates under a head of 150 feet along an electric railway line in the West and which was laid to replace a line of metal pipe that was completely destroyed by electrolysis in less than two years.

An inverted syphon is shown in the accompanying illustration, Fig. 3, used for irrigating purposes near Basin, in Wyoming. This inverted syphon is 48 inches in diameter and carries the water across the valley, following the profile of the country exactly with very little excavation, and indicates clearly the method employed in the Western States for conveying water not only for irrigation purposes, but also for hydro-electric power services.

An example of a 58-inch continuous stave pipe for the latter use is indicated in the accompanying illustration, Fig. 4, showing where the water conductor passes through the tunnel in the side of the mountain. This hydro-electric power pipe is more than 28,000 feet in length and conducts the water for operating the turbine in the electric generating station, which supplies current for the electric lights and for operating the street railway for the city of Walla Walla, Wash. The illustration shows one of the trestles on this line and one of the several tunnels through which the pipe runs on its way to the power plant. The lowest point on one of the trestles is under three hundred feet head, which is



1. CONTINUOUS WOOD STAVE STAND PIPE AT WALLA WALLA, WASH.



2. CONTINUOUS WOOD STAVE PIPE ALONG ELECTRIC RAILWAY.
Displacing Cast Iron Pipe Destroyed by Electrolysis.

equivalent to one hundred thirty pounds pressure per square inch. A remarkable incident, which shows the reliability of this form of water pipe, may be mentioned which is of special interest. The trestle at the point above mentioned in this pipe line during a freshet two years ago last spring was washed out, leaving the pipe suspended in mid-air for a span of 60 feet without injury to the pipe and without leakage of water. Of course this would be impossible with iron or steel pipe on account of its enormous weight, and shows one of the advantages to be gained by the use of the machine-banded and continuous-stave wood water pipe in addition to its low cost.

Cement Stucco

By Albert Moyer, New York City

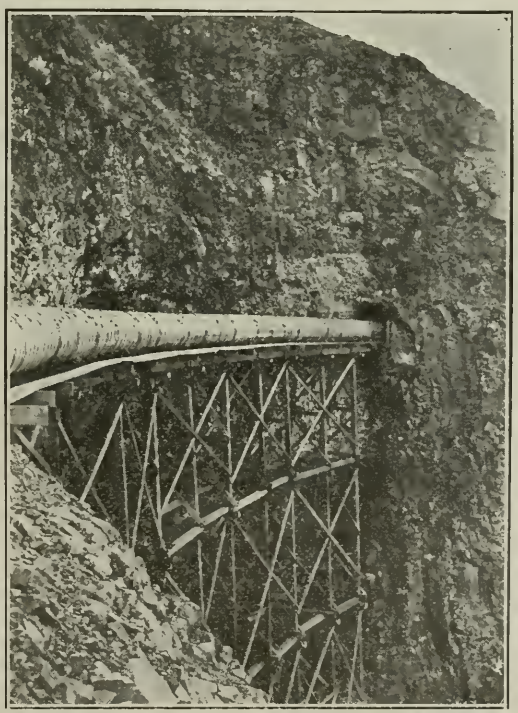
THE history of stuccoes does not furnish sufficient information and data to be of practical value in the manufacture of the present-day Portland cement stuccoes. There are records standing 350 years B. C. of stuccoes made from vastly different materials than are of economical use at the present time, and we find that such stuccoes were almost invariably used in the warm climates where the action of frost would not tend to disintegrate the rather poor material which was then available.

There is every reason to believe that originally these stuccoes were intended to cover up and protect inferior building stone and unburned straw brick. The archæology of stucco would tend to show that from an artistic standpoint this method of decoration was a development of the wattled buildings, which were plastered with clay and different muds hardened by being baked in the heat of the sun. Therefore, in this instance, the use of clay plaster over wattled houses was to protect an inferior building material.

Today stucco is used for a similar purpose, that of protection and pleasing surfaces. It would, therefore, seem advisable to recommend a material which would best serve the purpose of protection and artistic merit. Stucco or plaster should never be used as an imitation of other building material. "To cover brick with plaster and this plaster with fresco is perfectly legitimate, but to cover brick with cement and to divide this cement into joints that it may look like stone is to tell a falsehood, and is just as contemptible a procedure as the other is noble."

To carry out these ideas we desire to

3. CONTINUOUS WOOD STAVE PIPE INVERTED SIPHON.
Near Basin, Wyo.



4. CONTINUOUS WOOD STAVE POWER CONDUIT NEAR WALLA WALLA, WASH.

recommend only Portland cement stucco for exteriors, as this is the only hydraulic material which will stand the action of the elements.

From the artistic side we would also recommend such surface finish for stucco as will cause both natural color and pleasing texture. It would be well, therefore, to expose to view the aggregates used and avoid as far as possible exposing the bonding material—Portland cement.

There is no artistic reason for allowing only the bonding material to be displayed to the eye. On very large jobs the surface can be cleaned off by means of a sand blast, and on smaller jobs the surface may be cleaned, exposing each grain of sand, by means of muriatic acid in dilute solution, 1 part commercial muriatic acid, 4 to 5 parts clear water.

Where white aggregates are used the surface may be cleaned off with a solution of sulphuric acid, 1 part acid, 4 to 5 parts clear water. The sulphuric acid leaves a white deposit and therefore should not be used excepting where the aggregates are white.

Another method is to scrub the surface while yet green, say within 24 hours, with a house scrubbing brush and clear water. This is more difficult than the others for the reason that if the stucco is allowed to remain too long before scrubbing it will be too hard to remove the coat of neat cement from the outside of each particle of sand or other aggregates; and if scrubbed when it is too soft the surface may be damaged and difficult to repair.

If the character of the available aggregates will not present a pleasing surface when exposed the following surface treatment may be used: While the last coat is still thoroughly damp apply a Portland cement paint composed of 1 part Portland cement, 12 per cent. of the volume of the cement of well hydrated lime, pulverized form, and 1 part of the volume of the cement of fine white sand. Mix with water to the consistency of cream or the ordinary cold water paint. Stir constantly and apply by using a whisk broom, throwing this paint on with some force. Keep this finish surface damp for at least six days or longer if economy will permit. Do not allow it to dry out in any one place during the week. If necessary protect by hanging tarpaulins and using a fine spray of water playing on several times during the day by means of a hose. This will give a pleasing light gray color of excellent texture.

Stucco may be applied to various building materials. There is hardly any reason at the present time for stuccoing stone buildings. The procedure at best is difficult and hardly to be recommended. Our building stone is usually an excellent material and, therefore, does not require either protection or covering to produce pleasant effects.

New brick may be covered with stucco very successfully. The joints should be first raked out half an inch. The brick must be saturated with water. It is always best to start stuccoing at the top of the wall and work down between the pilasters or corners, finishing a whole strip or whole side wall from top to bottom in one day. Thus no streaks or cracks are formed where one day's work ends and another begins. By this method the wall can be kept wet ahead of the work by means of a hose. The second coat should be put on as soon as the first coat has stiffened sufficiently to hold in place and stand the pressure of the trowel. This second coat should be well scratched and the finish coat applied while the second coat is damp. The finish coat should then be kept wet, protected from the rays of the sun and as far as possible from drying out. This can be done by hanging wet cloths over same. This rule of keeping each coat moist until the other coat is applied and protecting after applying the finish coat must be observed in all forms of Portland cement stucco.

If the stucco is to be applied to metal lath or wire cloth the metal should be plastered on two sides so that it is entirely encased in mortar in order to avoid rusting. If this is impracticable then the metal lath or wire cloth should be dipped in a paint made of equal parts of neat Portland cement and water. Immediately after dipping the metal lath or wire cloth should be tacked onto a frame in the position it is intended to occupy. As soon as the neat Portland cement has hardened on the metal apply the first coat of stucco. Hair should be added to the mortar to be applied on wire mesh or expanded metal. One bag of cement, one pound of hair.

If plaster boards are used they should be nailed on the frame work of the building, leaving at least a quarter of an inch joint between each plaster board, this joint to be filled in with lime putty, otherwise each plaster board will cause square cracks on the outside of the stucco the size of each board.

A convenient method of waterproofing plaster boards is easily available.

The boards may be painted with two coats of any of the reputable bitumen waterproof paints to which plaster adheres. Then about 24 hours after the bitumen paint has been applied, and within six days, apply the first coat of stucco.

For stucco on terra cotta blocks great care should be exercised in keeping the blocks thoroughly saturated with water, for if the blocks are not saturated they will pull the water out of the mortar and it will crack and disintegrate. Portland cement requires water until it has thoroughly hardened, which ultimate hardening usually takes from 14 days to a month. It is not always necessary to play the hose on the wall for a month, although it would be advisable. The dews at night, the dampness in the atmosphere and the rain will furnish the necessary moisture provided the material on which the mortar has been plastered has not too great an affinity for water.

In order to prevent the porous hollow terra cotta tile from sucking the moisture from the stucco and also to furnish waterproofing and an additional bond other than that which would be given by the key, it is good practice to paint the surface well with two coats of bituminous paint, equal to such paints as Dehydratine, Minwax, R. I. W. or X-Hydro-Plastic. It is important that the first coat of stucco is placed over this paint after 24 hours and within six days.

Proportions for a good stucco should be 1 part Portland cement, 2½ parts coarse, clean sand, (If coarse, clean sand is not available use only 2 parts of sand). Add 10 to 15% of well hydrated lime, dry pulverized, of the volume of the cement.

If it is the desire of the owner or architect to use the exposed aggregate method, interesting natural colors can be obtained by using the following materials instead of sand, the same proportions. Green, red, buff, black or white marble screenings all passing a No. 8 screen and all collected on a No. 40 screen. These different colored marbles and different colored sand where obtainable, can be used singly or in a combination. When exposed by scrubbing or the acid treatment very interesting results are obtained.

In mixing stucco great care should be exercised to obtain the thorough incorporation of cement, sand and the other aggregates. The sand and cement should be mixed together dry until an even color results. This can be done by shovelling and raking while shovelling. Water should then be added, being careful not to add too much water at a time and not to get the resulting mortar too wet, so that more sand or cement has to be added. Be very careful to bring the resulting mortar up to the proper consistency for plastering.

It is advisable to add to the mortar from 10 to 15 per cent of the volume of the cement of well hydrated lime. This should be mixed dry with the cement and sand before the water is added. The addition of hydrated lime tends to fatten the mortar, making it more adhesive and impervious.

Another specification which we believe will prove of considerable value is by the addition of mineral oil to wet mortar. After the water is added and thoroughly mixed with the mortar add 15 per cent of mineral oil and remix. If a light effect is to be produced use white oil, such as Oil Petrole, manufactured by the Chesebrough Mfg. Co.

When the oil is to be mixed with the mortar it is always advisable to use hydrated lime as we thus have a larger amount of emulsifying material.

The color obtained by the scrubbing or acid method is limited only to the available sands or marble screenings. The color will be the color of the aggregates. An excellent green can be obtained by adding 8 per cent of the weight of the cement of chromium oxide. This should be mixed dry with the sand, cement and hydrated lime.

Always keep in mind that the surface to which the mortar is to be applied must be thoroughly saturated with water, each coat of stucco must be kept moist, and the final coat must remain moist for at least one week and longer if economy will permit.

Stucco should not be troweled to a smooth surface. The artist painter would never think of smoothing the paint on his canvas by means of a straight edge. Texture and color are necessary if artistic results are to follow. By using the suggestions above outlined, the architect is privileged to select the aggregates from which the stucco is made and has in fact as great play in the planning of the color, tone and texture as has the artist in mixing the paints on his palette.

Water Rates and Records at Valparaiso, Ind.

By E. L. Loomis, Superintendent of Valparaiso Home Water Co.

PRIOR to January 1, 1910, the maximum charge for water by meter measure at Valparaiso was thirty cents per thousand gallons, with a sliding scale downward and a minimum monthly charge of one dollar.

Residences not provided with meters were on a flat rate, the charge for service being based upon the number of rooms and fixtures. For a dwelling of four rooms or less the charge was $5.00 per year, which entitled the consumer to hot and cold water at sink in kitchen. For a five-room dwelling the charge was $6.00; for six rooms, $7.00, and so on up. All fixtures other than at sink in kitchen were assessed as extras. For example, a bath tub was assessed $4.00 per year, closet $4.00, lavatory $2.00, sill-cock for full lot $6.00 for sprinkling season, etc. The rates charged on other fixtures were proportional with those named, likewise for properties other than residences.

The engineer's daily reports, which go regularly to the files of the office, indicate water and steam pressure, noted hourly, pumpage in gallons, pump counter readings and amount of coal consumed each day. A very complete small laboratory for bacteria, alkalinity and presumptive coli tests has been installed, and reports of daily analyses are made. These reports are tabulated and systematically filed.

Applications for water service are made in the usual way, signed by the applicant and kept in a book made for that purpose. The card index system is employed entirely, not only for service records, but for all accounts with consumers, meter readings, etc., as well. Water rate accounts are kept in alphabetical order, while the service records are filed numerically, thus making each a ready index to the other. Items of cash receipts are kept in a special ruled cash book, each line of which is numbered. This line number is triplicated, the corresponding number being given to consumer's receipt for payment made, and to receipt stub. Thus a three-fold and very effective check against error is employed. At the close of the day's business the cash book is ruled and footed, and the results carried in totals to the receipts of the general cash book. Should any sundry items appear for which special ruled and headed columns are not provided, they are carried forward into general cash book separately to be posted to the ledger. All invoices and bills are filed numerically in invoice books, the corresponding number to each being given to disbursement line in general cash book and to voucher check as issued in payment of bill. The general cash book is ruled and footed monthly for purposes of comparison only, thence the footings are continued forward until the close of the semi-annual period, at which time they are posted to the ledger. How satisfactory and accurate this system of receipts and disbursements has been may be inferred from the statement that not a single error in accounting has been disclosed since it was installed. It combines the good qualities of being easily used and understood, quickly audited, of ready reference, and, above all else, of reducing the liability of error to the minimum.

Next to rendering the public good service, a waterworks manager delights in the knowledge that his busis a "going concern," and he should at all times know exactly to what extent it is a "going concern." To do this requires an accurate and convenient system of records and accounting, without which few enterprises can permanently prosper. "Eternal vigilance is the price of success" just as truly in the water office as anywhere else, the principles of success in the waterworks business being synonymous with the principles of success in any other line of work. It comes, if it comes at all, only to those who deserve success, and it cannot be deserved save at the expense of constant attention to the details and duties of the hour. Let the meter department, for instance, pass by unnoticed for but a single month and the losses will begin to grow. In our plant this department is observed most vigilantly. Meter tests are frequently made and accurate records in detail maintained. Imagine our surprise soon after this system of inspection was installed of finding many meters under-registering from 50 to 70 per cent. Frequent inspection of flat rate fixtures also is amply rewarded by reduced pumpage

*From a paper before the Indiana Sanitary and Water Supply Association.

I. STREET SIGNS AND SUPPORTING POST, ROCHESTER, N. Y.

on account of waste and leakage. By such tests and inspection with us the total pumpage has been steadily reduced for several years, notwithstanding a healthy growth in new consumers, additional fixture installations, etc.

To such a marked extent has the business grown that it has been possible for the rates to consumers to be reduced. Beginning January first one dollar per year was deducted from the charge against every flat rate residence in the city. Fixture rates remain unchanged. Thus, the flat rate householder, who formerly paid $5.00 per year, now pays $4.00; he who paid $6.00 now pays $5.00, and so on. The maximum meter rate was reduced to twenty cents per hundred cubic feet, which amounts to the very small sum of six and two-fifth cents for each ton of water delivered. The minimum monthly meter charge, instead of being one dollar, as heretofore, is now but fifty cents.

By this method of reducing rates two very desirable objects will be observed to have been accomplished. First, the inducement held out to every flat rate consumer whose water costs him more than $6.00 per year to meter his service, thereby reducing pumpage on account of waste and leakage, and conserving the water supply. Second, to give to the very small householder, who cannot afford a meter, an exceedingly low rate. This latter may not be profitable from a financial standpoint, but it does possess the virtue of being good humanity at least.

The ideal system, the writer is aware, is the wholly metered system. But ours is not an ideal system. We are struggling along, as best we know how, to make it such for our people, but that end is not yet in view.

Meters are indeed valuable adjuncts to a waterworks enterprise. So is a good system of records and accounts. Likewise, is the question of rates a vital one. But uppermost of all in supreme import to a community is the question of service. Not only to render satisfactory service, but the very best service, should be the laudable ambition and watchword of every waterworks man. Not so much cheaper water, but better water, is the crying need of the hour. Water is the prime necessity of human life. With seeming prodigality has nature lavished upon us this immeasurable, unthinkable blessing for the use of man. And he who helps to conserve it and safeguard it and to pass it, pure, to the lips of the multitudes of his fellow-beings renders a service to the world as exalted as it is distinct and worthy.

Brick Pavements in Rochester, N. Y.

THE first brick pavements in Rochester were laid in 1890, aggregating about 1.5 miles. At the end of the year 1899 there were only about 5.5 miles, and a total of 11.38 miles in 15 years, or an average of ¾ of a mile per year. During the next four years, however, ending with December 31, 1908, about 33 miles were laid, or an average of about 8.25 miles per year. There are now 41 miles, or 645,000 square yards, of brick pavement. Brick pavements are now 22½ per cent. of the total paved street, the percentage having increased from nothing in 1900 to 5 per cent. in 1904 and to 22½ per cent. as stated at the present time. This exhibit certainly offers great encouragement to the paving brick industry.

Mr. E. A. Fisher, the city engineer of Rochester, recently called special attention to some of the points in regard to brick pavements in the city, stating that the city charter permits the common council to provide in an ordinance for pavements for the construction of any necessary local sewers, also sewer laterals and water services. It is also the practice to include in the same contract the trenching and back-filling for any water mains required. The electric light company and the telephone companies are required to construct the necessary conduits, and the gas company to lay the necessary mains, all in advance of the improvement; the work to be done either by the same contractor that lays the pavement, or under his supervision as to refilling trenches. In this way the entire responsibility for the integrity of the subgrade is upon the contractor, and his guarantee is not complicated by the work of others over whom he has no control. The minimum future disturbance of the street is also provided. This practice, he believes, is one of the points of perfection in a brick pavement.

It is the practice to put in the foundation for the street railway tracks and lay the pavement in the portion of

II. SWIMMING POOL, ROCHESTER MUNICIPAL BATH HOUSE.

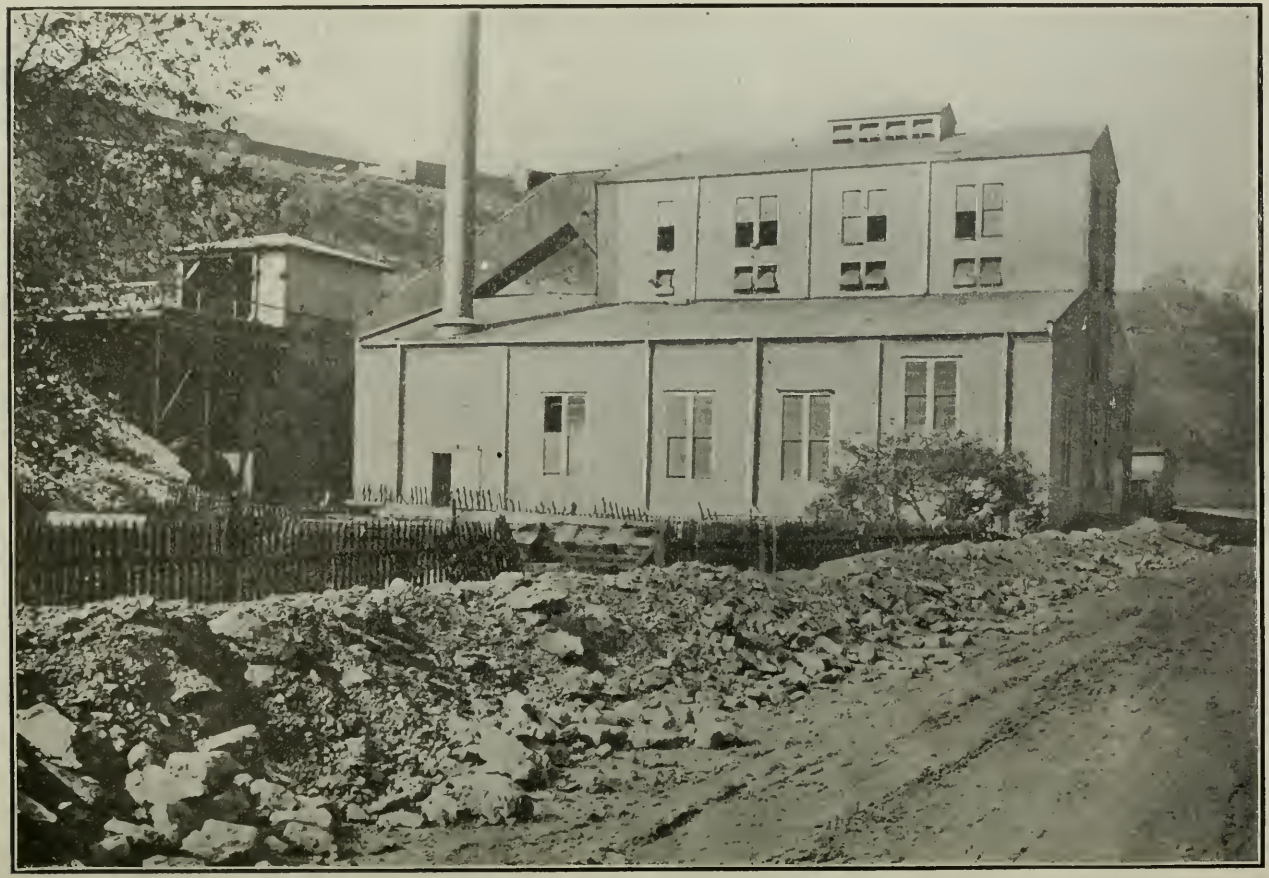
the street that the railway company is called upon, by statute, to maintain. It is the practice to provide a concrete foundation at least 6 inches thick for brick pavements in public streets. Even with the best of care in back-filling trenches and the most thorough rolling or tamping, some small settlements are bound to occur. The 6-inch foundation will successfully bridge such settlements. Experience teaches that it is better to do all the underground work above specified at the same time as the pavement is put down, and that it is a positive disadvantage to have such work done by another contractor, even if several years elapse before the pavement is laid. The worst settlements that they have had in paved streets have occurred over sewers laid from eight to ten years prior to the putting down of the pavement, where the surface was crowned up so as to shed water and the back-filling, except for a very limited distance from the top, received no consolidation whatever.

Mr. Fisher emphasizes some points made by Mr. Blair, the secretary of the National Paving Brick Manufacturers' Association, such as the method of providing expansion joints at the curbs by placing a board of proper thickness next to the curb and allowing it to remain from 24 to 36 hours after the pavement has been grouted, and then, after removing the board, fill the joint nearly full of paving pitch with a coating of sand to protect it from the sun. This method is much superior to the prevalent practice of pouring the paving pitch first. Some very serious damage has come to good brick due to the fact that the paving pitch in the expansion joint crosswise of the street had settled and the grouting filling the top of the surface of the joint had broken the tops of the brick for from one to three courses each side of the expansion joint. This bit of carelessness on the part of the contractor's foreman and the inspector gave the brick an undeserved bad reputation. He especially commends the portion of Mr. Blair's specifications relative to the grouting of the pavement, to contractors laying and guaranteeing brick pavements. The extra care required to do the work properly, as described, will be repaid a hundredfold by the greater durability and freedom from repairs during the life of the guarantee, and by the satisfaction of the residents with the quality of the work.

The committee of the N. B. M. A. recommended 20 per cent. maximum loss from abrasion in rattler, This percentage has been found, in general, to give a very good quality of brick. Mr. Fisher believes, however, that the limit should not be an arbitrary one, but it should depend largely upon the character of the traffic on the street in question. For streets of heavy traffic brick showing not more than 15 or 16 per cent. abrasion should be required, while for unimportant streets or roads, or for gutters in macadam streets of light traffic, a 24 per cent. brick would be satisfactory. He would advise a brickmaker not to furnish brick to a contractor for a street having heavy traffic under a specification only suitable for a street of light traffic. The loss to the brick industry as a whole by the use of such brick is beyond computation, and examples thereof are numerous. One example illustrative of this point is found in a brick pavement laid on East avenue in the year 1891 by one of the best paving contractors in the city, and at that time laid in the best manner known to the trade. This pavement remained in good condition for about eight or nine years, after which it became very rough, and later was worn so badly in the center of the street that it was necessary to make quite extensive repairs. The brick eventually became worn to a thickness of about 1½ inches, when it was impossible to repair with new brick and the repairs for the last three years the pavement was maintained were by filling up the holes with asphalt where the brick had worn entirely away. Some of the best of these bricks were tested in the rattler and gave results of about 23 per cent. The average was much greater. The brick was altogether too soft for the traffic passing over this street. The same brick was laid on a residence street of light traffic, by the same contractor, in the same year, and is now, after 17 years' use, practically in as good condition as when first laid. The joints were filled with paving pitch instead of cement grout.

Another example: A brick pavement was laid on a portion of East Main street in the year 1898. Some of this brick was taken up and tested during the year 1907, after 9 years' use in the street, and showed a little less than 14 per cent. abrasion in the standard rattler. The pavement, although subjected to rather heavy traffic, showed no appreciable signs of wear during its 9 years' use. The pavement was made of wire-cut brick laid close and well grouted.

The question of whether a pavement should be guaranteed at all is one that



III. GARBAGE REDUCTION PLANT AT ROCHESTER, N. Y.

has received recently a great deal of consideration from municipal officers. In Rochester, on account of the large amount of underground work done, it is desirable to have a guarantee of sufficient length to show whether the back-filling has been properly done and also that any defective brick may be discovered. The general ordinance of the common council, under which all pavements are laid, provides that they shall be guaranteed for ten years. This practice arose about 12 years ago, when the department had no facilities for testing asphalt pavements, and it was decided, upon the recommendation of the city engineer, that an asphalt pavement should be guaranteed for ten years. It was not his intention at that time that other pavements that could be inspected and passed upon as to their wearing qualities should be included in this guarantee. The builders of asphalt pavements, however, represented to the common council committee having the matter in charge that it was unfair for them to guarantee their pavements for ten years and to permit other pavements to be laid under a less guarantee.

The city now has provided itself with proper apparatus for testing asphalt pavement, as well as other kinds of pavements, and it is no longer necessary that the ten-year guarantee should apply. The general practice is to reduce guarantees to at most five years, and it has been recommended that this change be made in the general ordinance. It is a mistaken idea of some taxpayers that they are getting something for nothing. The general result, however, is exactly the contrary. As a general rule in the long term guarantees they pay for something and get nothing. No contractor who knows his business will accept of a long-term guarantee for maintenance without a sufficient addition to his bid to cover all contingencies. A five-year guarantee is all that is necessary to determine whether the work and material comply with the specifications.

Special Services to Rochester Citizens

The street sign is a problem to which a generally accepted solution has never been found. Tastes, customs, conditions of street corners, funds, all vary and the individual sign is so small that it is usually considered unimportant. That it is very important is recognized by every traveler who wishes to find his way about a strange city, and sometimes by a citizen trying to find some one in an unfamiliar part of his own city. One of the styles of sign used in Rochester, N. Y., which is wholly independent of any local conditions except room to set it where it can be seen, is shown in the first of the accompanying photographs.

The swimming pool in the public bath house is shown in the second photograph. This bath house has gradually grown from a remodeled small building. The swimming pool, 46 by 80 feet, 3 feet deep at one end and 7 feet at the other, was constructed in the rear of the bath house in 1905. In 1906 the pool and some additional space was enclosed by a brick wall and the roof was put on it. This is followed by an addition to the swimming pool enclosure to provide dressing accommodations for men and women and a heating plant for water and buildings so that the pool can be used in the winter also. Nearly 70,000 baths are taken in a year, nearly one-eighth being taken by women.

The third photograph shows the garbage reduction plant, which was put up by the Genesee Reduction Co., under a five-year contract, by the terms of which the city pays some $65,000 a year, including inspection and other general expenses, for the collection and destruction of the garbage. The plant is within the city limits, and the company is required to conduct it without nuisance.

EDITORIAL COMMENT

Determination of Qualifications of Engineers.

Depreciation and Sinking Fund Accounts.

DETERMINATION OF QUALIFICATIONS OF ENGINEERS.

The following editorial appeared in a recent number of *Surveying and the Civil Engineer*, a youthful English periodical:

Our American contemporary, MUNICIPAL ENGINEERING, in discussing the introduction of a bill in the New York Legislature, which proposes to license civil engineers in that State, plumps for the examination test for determining the qualifications of engineers seeking employment from State, county, city, or board having charge of public construction work. The character of the machinery for carrying on this work must, it says, be determined according to the necessities of the case in any given State. In New York, where there are great engineering organizations within the great city and other great engineering organizations in charge of State boards and departments, there must be a more flexible central organization than in a State where the engineering work is less extensive and the principal offices to be filled are those of city and county engineer and their subordinates, and an occasional engineer of a State or county or city board.

A State board of examienrs of engineers is the most obvious director of such an organization, and it should, in our contemporary's opinion, be given considerable leeway, although some restrictions upon its action would undoubtedly be desirable. It is only intended here to suggest this protective measure for the State as the one most easily defended, the one most readily carried through the Legislature. The adoption of such a plan would, it considers, have a most salutary effect upon the engineering profession in general. If the methods of putting names of competent engineers on the lists for the various grades of appointments are as good as they should be, the certificate of eligibility will be the best evidence an engineer can have of his technical standing, and the State's examination will be taken by many who do not expect to seek public employment, simply that they may have the certificate of attainment. Employers will soon come to demand such certificates as evidence of competence. Such voluntary examinations as have been devised by organizations of engineers in England show that this will be the effect. The only problem is to secure a competent examining board with a reasonable set of instructions by the Legislature.

We in this country have no desire to see a State examination. The organizations of engineers referred to are quite capable of running their own examinations; indeed, we are getting badly bitten by the examination craze, and a ten-year interregnum would be of considerable use in giving many a really capable man a chance of showing his worth. With voluntary examinations we have no fault to find. If a man cares to waste a couple of years of his life in cramming himself with mental food which he must disgorge on the first opportunity, he is perfectly at liberty to do so. He can recover lost ground afterwards, if he has not gone too far. The ill-effects of a course of tuition in road construction may be minimized by a couple of hours' run on a steam-roller, and a 'swot' for the examination of one of the sanitary bodies may even become a matter for self-congratulation when the relative positions of the socket and spigot end of a drain-pipe are clearly understood. The real value of an examination lies in the incentive it gives to study. The man who might never otherwise open a book is compelled to burn the midnight oil; but would it not be much better if the incentive were self-improvement without any question of reward? The evil is especially noticeable in the case of the scholastic profession. There, every one has to pass an examination of some sort or another, and it is really surprising how appallingly very seldom either one or the other opens a book when once the need for study has passed.

Our English contemporary is evidently in almost complete accord with

the position taken by MUNICIPAL ENGINEERING, and gives the experience with the English form of voluntary examinations as the basis for the objection of English engineers to a compulsory State examination, and thus supports the objection made to the proposed New York statute subjecting all engineers to examination.

The State has an undoubted right to protect itself and the municipalities and boards created by it from the consequences of incompetence in their officials. Too many of these officials are unable to judge of the qualifications of technical employes, and there will be a very material improvement if their power of choice is limited to a list of men declared by a competent State board to be competent for the work for which they seek employment. Whether these qualifications should be determined by a scholastic examination or by an examination of the work done by the candidate or in part by each should be left to the judgment of the examining body, as it is in the case of the U. S. Civil Service Commission's examinations of engineers for special services. But with a competent State Board having sufficient authority over its modes of procedure, an eligible list can be formed, which will have names of practical engineers, classified according to the demands of the various kinds of service. One of the principal reasons for incompetence in municipal engineering work will thus be removed very largely.

The examination is voluntary in the sense that no engineer need take it who does not wish to, and it is thus agrees with the position assumed by the English engineers. But if an engineer desires municipal, county or state employment he must secure a place on the eligible list for the class or classes of employment which he is seeking, not so much for his own benefit as for the protection of the municipalities from engineering incompetence or rather from the ignorance of the employing officials as to what constitutes a competent engineer. A competent board will soon establish a reputation for choosing good men for its lists, and most engineers seeking general employment will find it to their advantage to put their names on these lists. Thus the engineering profession will secure the benefits of standards of qualifications without the disadvantages of the more perfunctory and mechanical administration of a compulsory law covering the entire profession, while the State and its subsidiary corporations and boards will secure the protection, the need of which is now so often and so strongly demonstrated.

DEPRECIATION AND SINKING FUND ACCOUNTS.

A recent discussion of depreciation in water-works accounts with reference to uniform reports, by the New England Water Works Association, a report of which appears in the June number of the journal of the association, suggest an extension of the discussion which appeared in MUNICIPAL ENGINEERING for January, vol. xxxviii, p. 33.

For the purpose of securing uniformity in municipal reports it is necessary to determine a method of keeping accounts of depreciation and to follow that method without reference to any other account, but when the ultimate results of the operation of a plant are desired, the figures obtained from this account must be modified by the results of the sinking fund and bond accounts, due attention being paid to methods of investing money in the plant other than borrowing it by the sale of bonds. The intimate relations of these sets of accounts, capital stock, bonds, sinking fund, depreciation are shown in the editorial above referred to.

The Association discussion was opened by Harry S. Chase, a certified public accountant who has had several years' experience as superintendent, treasurer and manager of water and gas plants, and was restricted to the depreciation accounts, although it ranged some distance from the relation of these accounts to uniform reports.

Mr. Chase quoted the instructions of the U. S. Census department regarding depreciation accounts in reports to that office, and outlined the various items of the blank for reports, which are the same as those given in the report of the committee on a uniform system of accounts and reports of the American Water Works Association, which is reviewed in vol. xxxviii, p. 333. He criticised the forms in that they do not provide for depreciation reserve accounts in the list of liability accounts.

Mr. Chase seems to recommend the formation of this account by setting aside at regular intervals, say monthly if balances are taken at such intervals, assumed percentages for depreciation of the various classes of assets provided for in the uniform report blanks, these sums forming a fund against which should be charged the cost of such renewals as are properly chargeable to depreciation, as distinguished from new construction, which is charged to capital, and maintenance and repairs, which are charged as expenses of operation payable directly from the operation receipts each month.

If the assumptions of life of the various parts of the plant are correct, these renewals chargeable to depreciation might theoretically occur at the ends of the periods of life and the depreciation reserve fund to equal the cost of renewal would be made up by the annual setting aside of a sum which, with the interest on the investment, would amount to the cost of the renewal. Practically the renewals take place at intervals during the life of the plant, so that there must be withdrawals from the depreciation reserve fund before the end of its period, and its treatment like a sinking fund for the retirement of bonds at maturity will not be quite correct. For simplicity we may assume with those participating in the discussion that water works depreciate as a whole during a life which averages 50 years. A sinking fund would require an annual addition of less than 2 per cent to renew the plant at the end of the fifth year. If the depreciation were at the uniform rate of 2 per cent a year and could be taken care of each year, a depreciation reserve fund would not be required, and 2 per cent of the cost of the plant would be set aside each year from the reserve to take care of the depreciation of the year. The actual fact will lie between these two extremes and an appropriation of 2 per cent of the cost of the plant each year to the depreciation reserve fund, if placed on interest, will more than meet the total withdrawals for renewals during the fifty years assumed life of the plant and turn the plant over as a new plant to the succeeding term.

It should be noted that the amount set aside for the depreciation reserve fund each year, considered in this way, is two per cent of the cost of the plant, and should not be computed on the value of the plant each year.

If there is a bonded indebtedness on the plant, some provision should be made for retiring this indebtedness when the bonds become due. A sinking fund to extinguish the debt at maturity is the logical method.

Now if the plant is built out of the proceeds of the sale of stock, or other direct investment of capital, there will be no sinking fund and the depreciation reserve fund will take care of renewals and will turn over the equivalent of a new plant at the end of the period if it is assumed of correct length.

If the plant is built out of the proceeds of the sale of bonds and is like the "one hoss shay," no depreciation fund will be necessary, for the sinking fund will retire the bonds when they mature and the plant will disappear, leaving the field open for a repetition of the procedure. But one of the funds is necessary therefore, and if both are kept in full operation for the full assumed life of the plant, it has been paid for twice and there is a profit of 100 per cent on the original investment in addition to whatever dividends or interest may have been paid during the period.

In any given plant the investment is doubtless partly of original capital and partly of borrowed money, so that both

depreciation reserve and sinking funds must be maintained, but both should not be computed on the total cost of the plant, but rather upon the proportion of the value belonging to each.

Since the plant must be kept running and left in first class condition at the end of the period, in the case of the bond issue for the total cost there must be some method of making the renewals that will be necessary before the end of the assumed period of its life. These might be provided for by new bond issues, by making the terms of the bonds less than the assumed life of the plant, or drawing from the sinking fund with the expectation of refunding the bonds, when due, to the extent of these drafts. For, if the plant is to continue to run in first class condition indefinitely, without the break assumed in the theoretical "one hoss shay" case, the bonded indebtedness can not diminish, but must remain continuously equal to the cost of the plant.

If equitable rates for service are to be insured, the above considerations must be taken into account in fixing them, for evidently the 100 per cent profit indicated under the assumption of the maintenance of both depreciation reserve and sinking funds computed on the total cost of the plant belongs to the consumers in a public service plant and not to the owners of the plant, whether they are private investors, who have already received the interest on the investment and the equivalent of its return to them, or are municipalities, whose general funds are no better entitled to the excess of income over proper returns on the capital invested.

If the depreciation reserve and sinking funds have been kept up to the proper amount, the value of the plant, for purposes of sale, as well as for purposes of computing rates for service, will be its original cost, including in that term all the additions to its first cost on account of extensions, new plants and such parts of renewals as are real additions to the value of the plant beyond the replacement of the outworn or outgrown part. If they are not kept up, then the value of the plant must be less than its cost by some amount representing the depreciation and the bonded or other indebtedness, with such additional allowance for failure to maintain the sinking fund as the cost of securing the necessary funds to take its place may show to be equitable.

There has been a tendency to compute the depreciation in a plant as a certain percentage of the value, deducting this depreciation for a year and adding the cost of new construction during the year to give the value of the plant on which depreciation for the following year is to be computed. The above course of reasoning throws doubt on the correctness of this process, which diminishes each year the amount set aside for depreciation reserve, while the actual depreciation is increasing each year until the time of renewal arrives, and in a plant without growth or expansion would ultimately wipe out the allowance for depreciation entirely.

These arguments assume that the rewards for good management of the plant have been taken care of by permission to declare larger dividends upon stock than it would be necessary to pay for interest on bonds, by allowance of a proper amount of stock, on which dividends may be declared, beyond the cost of the plant, or, particularly in municipal plants, by increase in salaries of managers or by transfers of surplus to the city treasury, and that these evidences of capital investment are not included in the computations of depreciation or sinking fund allowances.

THE QUESTION DEPARTMENT

Thickness of Retaining Wall.

Having little experience in heavy concrete work, I will ask your opinion as to proper thickness of wall, diagram of face enclosed.

I think ledge of rock will be found for foundation of middle section. Good stone culvert, in use for years,, will remain. I have suggested a batter of 1½ inch to 1 foot for outer face. Also reinforced construction, at least for higher sections.

A forty-foot street will be supported by wall, but with the exception of triangular section resting against wall, earth has been settled by many years' travel, if that amounts to anything.

J. A. W., ———, Mo.

The wall shown in the diagram is 168 feet long and has a maximum height of 30 feet, being composed of a section 70 feet long, varying from 5 to 10 feet in height, one 10 feet long and 20 feet in height, one 60 feet long and 30 feet in height, another 18 feet long and 20 feet in height, and another 10 feet long and 5 feet in height. The section of the 30 foot wall scales about 4 feet thick at the top and 8 feet at the bottom, with vertical back and the batter named above on the outside. The section also indicates rather indefinitely a filled street back of the wall with a present slope whose toe is near the location of the front of the proposed wall, so that the wall will sustain the earth to be filled into the approximately triangular space bounded by the present earth slope of the road, which is slightly curved, the back of the proposed wall, and the new earth surface at the level of the top of the wall. Presumably there is a similar wall on the other side of the road.

Have our readers any suggestions to make?

The problem seems to be that the usual retaining wall acting by its own stability, made up of weight and foundation base, the concrete takes the place of stone masonry, with the probable advantage of being monolithic. The ordinary rule for the thickness of a retaining wall with good foundation and ordinary filling is to make it one-fourth to one-third the height, where the batter is one in eight, as in the present instance. The above described wall lies between these limits, but quite close to the lower, so that a good foundation would be necessary for the highest part.

Some reinforcement near the face will reduce the probabilities of large cracks and will also add to the stability of the wall.

Value of Sand for Sidewalks.

Please find inclosed sample of sand that is in gravel here.

The gravel is a hard, flinty kind, but I was not just sure about the sand, so please give me some advice on same. Does the color hurt anything? The gravel and sand is to be used in concrete walks. This sand inclosed is a natural deposit in the gravel out of a bank. Any information will be appreciated.

N. B., ———, Ark.

The grains of sand seem to be quartz and flint similar to the gravel, and they are more or less cemented together by iron oxide. When water is added and the mixture is agitated most of the sand turns out to be very fine, some of it extremely so, and the proportion of this fine sand and the mud, which has probably some clay with the iron oxide, proves to be too large for use in the wearing surface of cement walk. The proportion of fine sand is too great for strength, and the grains of sand are too many of them coated with the iron oxide to make a good mortar or concrete. The surface of the walk would doubtless pit and discolor and would probably not be durable even if not subjected to much wear. A contractor would not be safe in guaranteeing a walk made with material as dirty and as fine as this sample of sand. It is doubtful whether it would pay to wash the sand, the proportion of loss being so great, but the small remainder after removing material that is too coarse and too fine would probably be reasonably good material.

Noise and Dust Nuisances.

This city desires to enact legislation looking to the doing away with unnecessary noises and dust. I understand that some of the eastern cities have been taking up the matter of unnecessary noises and I desire to know what they have been doing in order that we may enact an ordinance which shall be as nearly as possible a model one.

J. P. Wood, City Attorney,
Pasadena, Cal.

There has been some discussion of the matter of suppression of unnnecessary noises, but little of it has crystallized into state or municipal legislation. The municipal incorporation act of Indiana has as liberal provisions in this regard as are usual, and it is more specific than can be found in most states. They give the council power "to regulate or prohibit the use of hand-organs or other annoying instruments of any character, or other

music of itinerant performers in the streets, alleys or public places of the city"; "to prevent or regulate the use of fire-arms, fireworks, bonfires or other things or practices tending to endanger persons or property"; "to regulate or prohibit the ringing of bells, crying of goods or sounding of steam whistles."

An ordinance of the city of Indianapolis putting into effect part of the above authority is as follows:

An ordinance declaring it to be a nuisance to use or blow tin horns, trumpets, locusts, rattles or other instruments for the sole purpose of making a noise upon the streets, alleys, highways or public places within the city of Indianapolis; fixing a penalty for the violation thereof, and fixing a time when the same shall take effect.

1. Be it ordained by the Common Council of the City of Indianapolis, Indiana, that every person who shall use or blow (as above) shall be deemed and be held to have committed a nuisance; and every person guilty of violating the provisions of this ordinance shall be fined in any sum not exceeding $50, to which may be added imprisonment for any period not exceeding 30 days.

2. Publication provisions fixing time of going into effect.

There are similar ordinances regarding the sounding of railroad whistles, auction bells, etc.

The ordinance in Seattle, Wash., regulates the blowing of locomotive whistles within defined limits, letting off of steam, flat wheels on street cars, greasing of street railway curves, advertising noises, except bands of music, transportation of iron in a noisy manner, church and other bells.

The average city ordinance prohibits undue noise by persons in the street and the use of fire-arms or fireworks with certain exceptions and really affects nothing which is not otherwise classed as disorderly and so is subject to police control.

A sea-side suburb of New York has taken care of the noises of junkmen by charging a license fee of $5, which is increased to $50 if they make noises with bells, shouts, or otherwise. Hucksters and the like are charged $5 for wagon or $2 if on foot, the fee being trebled if noises are made to attract attention at a distance.

Newark, N. J., prohibits phonographs being directed toward open doors or windows.

Cleveland, O., has an ordinance prohibiting sounding of locomotive whistles, vessel whistles, stationary engines of factories and the like, for anything except warning of danger, of fire, collision or other imminent danger, and definitely prescribes the whistles for steam tugs.

Congress has passed a law giving supervising inspectors of steamboats power to regulate the whistling of boats on water under their jurisdiction, which is said to have eliminated eighty-five per cent of the noise due to this source.

New York prescribed a quiet zone, prohibiting street music or hucksters cries within one block of a church, hospital, or school between 9 and 4, but its provisions are so indefinite that it is not enforced.

Part of the above information is taken from a new book on "The Health of the City," by Hollis Godfrey, ($1).

Can our readers give any information concerning laws or ordinances governing objectionable or unnecessary noises?

Calcium Chloride as a Dust Layer.

Have you published anything in your magazine relative to the use of chloride of calcium on highways, or can you refer us to any work on road construction which covers the use of this material?

J. P. G., Saginaw, Mich.

Judson's "Road Preservation and Dust Prevention" ($1.50) gives some instruction on the use and value of calcium chloride for preventing dust on roads. Hubbard's "Dust Preventives" ($3) goes into a little more detail on this subject as well as all other methods of preserving road surfaces.

An article in MUNICIPAL ENGINEERING, vol. xxxvii, p. 236, contains much of the same practical information. One on "Dust Prevention by Chemicals" in vol. xxxv, p. 175, gives the results of tests on various roads and describes briefly methods of application. Another on p. 183 of the same number gives the methods and results of a test in the grounds of the Agricultural Department at Washington, D. C.

Street Railway Track Construction in Brick Street.

A street railway company has just asked for a franchise through our streets. Much of our street is paved with brick on 6-inch concrete foundation and 2-inch sand cushion and the remaining street will be paved at the time the track is put down. What foundation would you suggest under ties? What kind and spacing of ties? What provision for bonding rails? What weight and section of rail? Would you suggest special brick along rail? Would it be possible by using a special track fastening to use 60-pound A. S. C. E. section and is there such a track fastening on the market?

Most of the track will be single track in a 36-foot pavement. We desire to have a first-class construction without making the conditions too burdensome to the company and at the same time protecting the best interests of the city.

P. B. W., ———, Ill.

In the March number of MUNICIPAL ENGINEERING, vol. xxxviii, p. 152, will be found a paper on "Paving Along Street Car Tracks," by the chief engineer of the Indianapolis Traction and Terminal Company, which answers and discusses in detail the above questions. The sub-grade is excavated by him to a depth of 10 inches below the bottom of the ties and rolled till compact. The excavation is

filled with Portland cement concrete to within 5 inches of the top of the rail. The rail is a 9-inch, 90-pound girder rail laid on 6 by 8-inch white oak ties spaced 2 feet, so that the concrete covers the ties and encloses the bottom 4 inches of the rail. With a 5-inch T-rail, it would come to the top of the ties. A special beveled edge stretcher brick is used outside the rails with a wooden strip under the head of the rail to keep the rail from direct contact with the brick, reduce the effect of vibration and prevent the crushing of the brick by wide-tread wheels.

An article by the same author in vol. xxv, p. 342, describes a similar construction with a 7-inch Shanghai T-rail, using a special shaped nose brick next the rail to form a groove for the wheel flanges, which has proved quite satisfactory after some seven years' use. This same construction is compared with others in an article on "Paving Between Street Railway Tracks and Rails," by ex-city engineer B. J. T. Jeup of Indianapolis, in vol. xxxii, p. 327.

The principal requirements in street railway track construction, especially if the track is to be used by heavy interurban cars, are stability and durability. The deep rail, 7 to 9-inch, gives a stiffness which is lacking in the ordinary A. S. C. E. sections, and which is more necessary in a paved street than in a steam railway. The concrete foundation under the ties gives the solidity to the bed which is absolutely necessary for stability in the track.

The wooden ties are an element of weakness and of trouble, as they are imbedded in the concrete and the foundation must be renewed when decay makes it necessary to renew them. In vol. xxxii, p. 38, and briefly in vol. xxxiv, p. 40, is described a track construction which removes these difficulties and would be directly applicable to the present case and perhaps justify the 5-inch T-rail. It consists of longitudinal beams of concrete, reinforced by longitudinal rods if desired and tied together with rods if deemed necessary. In the tops of these beams are alternate large and small recesses. The large recesses receive rectangular blocks of creosoted wood, set on a layer of sand as a cushion and means of setting rails accurately to grade. The small recesses give opportunity for bolts or rods to fasten the rails to the concrete. The article has photographs showing the track under construction and completed. It is now in excellent condition after three or four years' wear.

If the company keeps the pavement between its rails in repair it will find the most stable construction the most economical. If the city must make the repairs it should insist on the most stable construction possible.

Street Grading Machinery—Cost of Quarrying and Crushing Rock.

This town will shortly be in the market for an elevating grader suitable for street grading where it is necessary to load the dirt on wagons. I should like to be put in communication with the producers of such machines and with any parties who would be likely to have a second-hand machine for sale. I would also very much appreciate the kindness if you can tell me if any one is building a combination traction engine road roller with gas power. I should also like to be advised where I can get up-to-date information on the cost of quarrying and crushing rock for concrete and road building.

T. S. D., ———, Iowa.

Names of makers of the machinery desired will be found in the "Business Directory," printed in each number of MUNICIPAL ENGINEERING, under the headings "Contractors' Tools and Machinery," "Crushers," "Engines for Grading," "Engines for Plowing," "Excavating Machinery," "Gas Engines," "Gasoline Engines," "Road Locomotives," "Road Machinery," "Road Plows," "Road Rollers," "Rock Crushers," "Scrapers," "Scraper Blades," "Street Contractors' Supplies," "Street Scrapers," "Traction Engines," "Wheel Scrapers."

The latest edition of Gillette's "Handbook of Cost Data," ($5) contains some figures on cost of quarrying and crushing rock.

There is a rather detailed article on "Quarrying and Crushing Stone," in MUNICIPAL ENGINEERING, vol. xxviii, p. 360; also some information on cost in vol. x, p. 202.

Filler for Brick Pavement.

I am interested in a brick pavement filler that will be of the very best for durability, least noise, and to be waterproof and admit of repairs with as little expense as possible.

What do you recommend, asphalt or Barrett's paving pitch?

W. E. S., Warrensburg, Mo.

The various fillers have their particular points of value and one should be selected for the particular work required of it. It can hardly be said that any one meets all the stated requirements with absolute perfection, and a valuable opinion cannot be given without full knowledge of the special conditions. Full information about them all can be found in the volumes of MUNICIPAL ENGINEERING. Much valuable information in great detail is obtainable from the manufacturers and advocates of the various materials and methods. Their names and addresses will be found in the "Business Directory" printed in each number of MUNICIPAL ENGINEERING, under the headings "Filler," "Filler Asphalt," "Paving Brick Association," "Paving Filler," "Paving Pitch," "Pitch," "Pitch Filler," "Asphalt Filler," "Mineral Rubber."

The following articles in MUNICIPAL ENGINEERING gives details about these various fillers:

In vol. xxxviii: "Specifications for Expansion Joints for Brick Pavements," p. 110; "Specifications for Laying Brick Pavements," p. 320, giving those adopted by the organization of municipal officials for standardizing paving specifications, using cement filler; "Brick Paved Highways," p. 396.

In vol. xxxvi: "Can Brick Street be Refilled with Waterproof Filler?" p. 243.

In vol. xxxv: "Coal Tar Pitch Filler," p. 39; "Brick Street Paving in Columbus, O.," giving experience with tar filler, p. 141; "The Proper Construction of Brick Street Pavements," giving experience with cement filler," p. 279.

In vol. xxxiv: "How to Apply Asphalt Fillers to Brick Pavement, p. 185.

In vol. xxxv: "Cement Filler for Brick Pavements." giving specifications and methods, p. 85; "Brick Pavements in Paris, Ill.," giving experience with cement filler; p. 160: "Sarco Filler for Block Pavements," giving the points of advantage in this asphalt filler, p. 282; "Pioneer Filler Asphalt," giving sources of information about this asphalt filler, p. 362; "Material for Filling Joints of Brick Pavements," p. 390, giving the experience of the engineer of streets of Newark, N. J., with tar and asphaltic filler and his resulting specification.

There are other articles in earlier volumes.

Sufficiency of Brick Specification.

The following is a copy of the specifications for a paving brick: "The brick must be hard burned street paving brick, smooth and free from checks or fire cracks. When broken the fracture must be smooth and straight and the texture shall be uniform throughout and not granular. The brick shall be not more than 4¼x4x9 inches nor less than 2½x4x8 inches in size and only one size of brick shall be used i any single contract. The best quality of what are known as number 2 brick may be used. They shall be sufficiently vitrified as not to disintegrate by the action of frost or the inclemency of the weather. Neither must they be overburned so as to be exceedingly porous or extraordinarily brittle. Each bidder must submit with his bid not less than six (6) brick as a sample of the brick he will use in the work, which shall be subjected to such physical tests as may, in the opinion of the engineer be necessary to determine their quality and durability for the work and the brick must be equal in all respects to the samples furnished. Samples as above specified may be submitted by manufacturers, in which case bidders proposing to use brick of such manufacturer will not be required to submit samples. The engineer and superintendent will use care and diligence in sorting and culling the brick and the contractor is required to assist and co-operate with them in doing so."

I would like to know what grade of brick you would consider was required under these specifications.

How would you ascertain the quality of the brick furnished for the work?

G., Logan, O.

The specification reads as though it were prepared to suit a special condition, the first sentences being descriptive of the appearance of the bricks which will be acceptable. Some of these items seem to the outsider rather difficult to comply with strictly. Apparently the specifications call for the best quality of No. 2 brick, whatever that may mean for the locality in which it is used, and the contractor or manufacturer practically defines No. 2 brick by means of the samples which he files under the requirements of the specification.

This definition should be and probably would be considered subject to the approval of the city engineer, through his acceptance or rejection of the samples filed as equal or not equal to "the best quality of what are known as No. 2 brick," especially since No. 2 brick may be classed according to whether they are over- or underburned in comparison with No. 1, and the two classes of No. 2 brick have quite different qualities.

When accepted by the city engineer these samples become the standards "and shall be subjected to such physical tests as may, in the opinion of the engineer, be necessary to determine their quality and durability for the work." According to the strict wording of the specification these tests are not the basis of the acceptance or rejection of the samples, although they may aid the city engineer in making his decision as to whether they are equal to "the best quality of what are known as No. 2 brick." The tests are rather to determine the quality of the accepted sample, so that there may be a basis for comparison of the sample with the brick furnished for the street. for the brick furnished "must be equal in all respects to the samples furnished"; a provision which requires that they be subjected to the same tests as the samples if a thorough comparison is to be made. The specification is lacking in descriptions of injuries to bricks which will cause rejection, possibly because this is also left to comparison with the samples filed. But if the sample bricks are subjected to the rattler test they will no longer be in condition to use for comparison as to external injuries.

It is evident that the softer No. 2 bricks will have quite different characteristics from those rejected from No. 1 on account of harder burning, so that the city engineer must either choose which class he will accept, if bricks of both classes are included in the samples, or must subject the two classes of bricks to separate tests. Since the tests are comparative among the filed samples of brick and the test samples taken from the delivered brick, comparisons with tests of other bricks are not called for. The rattler test may therefore be applied to the samples, classified if necessary as above stated so as to get the most readily comparable results, but, generally speaking, and using samples taken at random with-

out classification, the rattler test results on such culls as are ordinarily denominated No. 2 brick would not be sufficiently uniform to give any reasonable basis for comparison.

It is to be definitely understood that the specification does not require a first-class brick, and that it depends upon the judgment of the city engineer as to whether the "best quality of what are known as No. 2 brick" are selected. It may very well be the case that the said best quality of No. 2 will fill all the demands of the traffic on the street for which they are intended, in which case the use of the poorer brick, if it results in a large saving in cost, may be fully justified.

Municipal Stone Quarries and Crushers.

Can you furnish me the names of any U. S. cities owning and operating a municipal stone quarry which furnishes crushed stone for the city's road construction and repairs?

T. J. W., Milwaukee, Wis.

Among the municipal stone quarries are those at Auburn, N. Y., Newton, Mass., Baraboo, Wis., Boston, Mass., Kankakee, Ill., Geneva, N. Y. Some of these own the quarries and some own their stone crushing and screening plants which they move from one quarry to another or in which they crush stone purchased from private quarries and hauled to the plant. Will our readers inform us of other plants of either kind?

Cost of Brick Paving with Granite Curb.

Will you kindly send me what data you may have relative to vitrified brick paving with granite curb. What I need especially is the cost here in Florida, but in case you have none, the cost at the nearest point will do.

W. T. T., St. Petersburg, Fla.

The only figures at hand are from Savannah and Valdosta, Ga., and St. Augustine, Fla., where brick pavements recently laid with no foundation other than sand cost from $1.63 to $1.70; in Columbus, Ga., where brick pavement on concrete foundation and with cement filler cost $1.73; and in Atlanta and Macon, Ga., where it cost with pitch filler from $1.85 to $2.08 per square yard. It is probable that a Florida pavement with granite curb would cost about the same as the Atlanta or Macon pavements quoted, if on concrete foundation.

In Professor Baker's book on "Roads and Pavements," ($5) will be found a collection of cost of details, including rolling subgrade and laying concrete, 47.2 cents; sand cushion 5.5 cents; brick laid, 68.3 cents; filling joints and top dressing with sand, 2 cents, making a total of $1.27. To this should be added for cement filling and expansion joints 11.5 cents; granite curb, according to width of street, say 15 to 25 cents; administration and profits, say 30 to 40 cents; and grading, according to the requirements of the particular case; putting the total cost somewhere between the limits named. Variations in cost of labor and materials will increase or decrease the cost, the resultant probably being an increase for Florida over Professor Baker's figures.

Municipal Abattoir.

The writer has been appointed chairman of a committee to work in conjunction with the Board of Health of our city for the purpose of improving the quality of meat and milk consumed by our people. Will you kindly give me the names of some of the cities who have solved this problem, or the address of some one to whom I might write to be advised on this subject. An early reply will be very much appreciated.

S. J. R., Ft. Smith, Ark.

Can our readers give any help toward answering this question? The writer knows of no municipal abattoirs in this country. Toronto, Ont., is said to have a successful municipal abattoir, and Montreal, Que., is also supplied with one. They are quite common in European cities.

One in South Africa is described with illustrations, in MUNICIPAL ENGINEERING, vol. xxxv, p. 224.

Nashville, Tenn., has one authorized, "Nashville abattoir," operated by private parties, and the ordinance fixes prices that can be charged for slaughtering animals and cold storage of meats.

Seattle, Wash., has a similar ordinance regarding authorized slaughter houses.

There is more or less municipal control of the operation of abattoirs in Boston, Mass., New Orleans, La., Terre Haute, Ind., and others, but nothing approaching municipal ownership or operation so far as the writer knows.

Remedy for Slippery Pavement.

We are having some trouble with a wood block pavement on account of the slippery condition. Under certain atmospheric conditions, it is exceedingly slippery and horses find difficulty in holding their footing. The blocks are of creosoted South Georgia pine and laid to a true surface. Can you suggest a remedy for the trouble?

J. W. BARNETT, City Engineer.
Athens, Ga.

Foreign cities in which wooden block paving has been popular for many years report the same difficulty. It exists in rather exaggerated form in London on account of the frequent humidity of the atmosphere. The only satisfactory remedy seems to be sanding the roadway at the time of slipperiness and sweeping up the sand a few hours later when the humidity of the air has diminished enough to permit the street surface to dry out. This occurs so frequently in London that regular provision for the sanding and sweeping is made, so that the work can be done before the traffic begins in the morning and the sand can be removed before it is crushed and dried and blown about as dust. Coarse sand or fine gravel (called

shingle) is used for the purpose and a light sprinkling of the sand is all that is necessary.

The effect of slipperiness can be diminished by reducing the crown of the street. This can be safely done if the pavement is well laid with a smooth, even surface and joints completely filled, only enough fall to the gutters being kept to insure that water will not stand on the clean pavement, and the pavement being cleaned at least as frequently as once a day. If there is a pronounced grade in the street, this reduction in the crown is still more desirable.

Paving Over New Sewer Trenches.

Is it considered bad practice to sewer and brick a street both in the same season? W. E. B., Mt. Gilead, O.

This is not the best practice but it is frequently done. In some soils the practice is dangerous, but usually, if great care is taken in compacting the material in the trench thoroughly and a good concrete foundation is put under the brick, the practice is reasonably safe. No general rule can be made for compacting all materials. Each one requires its own methods, tamping in some, flushing in others, dryness or moisture according to the demands of the particular material.

A badly filled trench in clay may give more trouble from settling after several years than a well filled trench paved over the first year. A skillful engineer on the roller which compacts the subgrade under the concrete for the brick pavement can locate most of the weak spots in the sewer trench.

Books on Macadam Country Roads.

Please refer me the best work on road construction with special reference to macadam county roads to cost from $1.50 to $3.00. SUBSCRIBER.

The writer does not know any book that just fits these requirements.

Aitken's "Road Making and Maintenance" ($6) gives full detail of English practice and is an excellent book on macadam road building from quarrying rock down. It devotes a few short chapters to pavements, but very little space to the modern tar, oil and asphalt macadams.

Baker's "Roads and Pavements" ($5) devotes about one-fourth its space to macadam road building, with similar limitations as to modern forms. It has good chapters on gravel roads and about half is filled with discussion of street pavements. The book is excellent, excepting the chapters on earth roads, which are harmful rather than valuable.

Byrne's "Treatise on Highway Construction" ($5) is probably the best American book on the subject. Pavements take a comparatively small part of the 800 pages in the book.

Gillette's "Economics of Road Construction" ($1) is a nervously written sort of book that requires considerable knowledge of the subject to make proper selection of the valuable matter in it.

Judson's "Road Preservation and Dust Prevention" ($1.50) is devoted entirely to the modern forms of treated road surfaces.

Morrison's "Elements of Highway Engineering" ($2.50) is a college text book, half of which is given up to pavements. It has the limitations on the practical side due to its college authorship and purpose.

Greenwell's "Roads" (5 shillings) is a fairly good book on English practice.

Spalding's "Roads and Pavements" ($2) is another text book, much more practical than the one above mentioned, but quite brief and devoting less than half of its 340 pages to macadam and similar road surfaces.

Who Supplies Cobblestones?

I have had several gentlemen here ask me the price, etc., of cobble stones for pavement. If you can give me some information along this line I will appreciate the same. I would like to have the address of some firm or firms handling cobbles and price per yard in car load lots.
N. W. G., Helena, Ark.

There is so little demand for cobblestones that, so far as the writer knows, there is no one making a business of supplying them. Some firm supplying gravel may be able to get together a supply of cobblestones if a special arrangement is made. The cost would depend very largely upon the expense of saving the stones and shipping them. Perhaps some one can be found, not too far away, who would like to get rid of the stones culled from his gravel deposit or rejected by his gravel or sand screen, in which case the cost of the cobbles should not be great.

Can our readers supply any information about a possible source of a supply of cobblestones not too far from Helena, as measured by freight rate?

Information About Grade Crossings.

Will you kindly inform me whether you have any material in regard to grade crossings in cities which we could either borrow or purchase. I am looking up this subject for the civic department of the Woman's Club of this city and shall be glad of any information or material which you can give me.
M. W. F., Louisville, Ky.

There has been considerable material on this subject in technical periodicals during the past twenty-five years which is indexed in the periodical indexes doubtless on file in the public library. Probably the best discussions of the subject will be found in the reports of the Elevated Track Department of the Chicago Bureau of Public Works, particularly those made before the track elevation began and during the early years of the work. Possibly these reports are yet obtainable of the

Chicago Department of Public Works and possibly they are on file in one or more of the Louisville city offices.

In MUNICIPAL ENGINEERING will be found a brief illustrated article on the Philadelphia subway and elevated tracks in vol. xxxv, p. 217, and another on the general plans in vol. xxxiv, p. 92. A history of the efforts toward track elevation in Indianapolis in vol. xxxiii, p. 30, vol. xviii, p. 335, vol. xvii, p. 164. Chicago and suburbs track elevaton is considered n vol. xxv, p. 48, xxiv, p. 286, xxi, p. 347, xvi, p. 397. Some Detroit grade crossings are described in vol. xxvi, p. 192.

There is an editorial on the "Abolition of Grade Crossings" in vol. xxiv, p. 24; an illustrated article on "The Abolition of Railroad Crossings at Grade" in vol. xxi, p. 60.

A report on grade crossings in New York City was submitted to the Public Service Commission of that city early this year, by Edward M. Bassett, which discusses the problem for that city and the defects of the New York state law. It has as appendices a history of the grade crossing case in Minneapolis and a brief statement on the elimination of grade crossings in the cities of Chicago, Buffalo, Cleveland, Detroit, Ft.Wayne, Indianapolis, Kansas City, Milwaukee, and Philadelphia, the states of Connecticut, Massachusetts, Vermont and Wisconsin, and in Canada and Great Britain.

The American Railway Engineering and Maintenance of Way Association, 962 Monadnock Building, Chicago, Ill., has published in Bulletin 99 a bibliography on the subject of track elevation and depression in cites, whch can be obtaned for 50 cents from the secretary at the above address. The roadway committee presented a valuable report on the subject in vol. 9 of the proceedings of the association, 1908, giving a tabulated statement of the work done in the cities engaged on it. These proceedings can be procured at $2.50 in paper, $3 in cloth or $3.50 in half morocco.

Depth to Lay Water Pipe.

In conveying water through a 2-inch pipe a distance of two miles on a graded slope of 18 inches per rod to empty into an open storage tank, where the weather in winter falls to 20 below zero, how deep would you advise to cover the pipe? How many air cocks would be necessary How does wood pipe compare with iron for water works systems?

G. C. M., Richfield, Utah.

The duration of the low temperature has more effect upon the depth for laying pipe than the actual minimum. If the given minimum is unusual and lasts only a few hours, the pipe can be laid in a shallower trench than if the temperature remains quite steadily at a higher average low temperature. Thus the general rule for depth of pipe in the eastern states is 4 to 5 feet for latitude 42 and 6 to 7 feet for latitude 45, whereas for the Northern Mississippi and Missouri valleys it is 5 feet and 7 feet respectively. Altitude above the sea has something to do with this required increase in depth. Small pipes require greater depth than large ones. Taking into account the latitude of Richfield, its altitude, the probable brief duration of the minimum temperature and the small diameter of the pipe, two of which tend to reduce and two to increase the depth, it is probable that a depth of 4 to 5 feet will be ample, and if the average winter temperature, day and night, is not far from 32 degrees, 4 feet will be sufficient. But if the average winter temperature keeps up an active freezing process after several weeks, then the depth should be 5 feet.

If the pipe is laid on a uniform slope of 18 inches per rod, about 9 feet per hundred, there will be no need of air cocks. If, as is probably the case, the pipe has occasional summits and depressions, there should be an air cock, and, preferably, a small air chamber at the top of every summit. The air must be let out of these points occasionally. The length of time between visits will depend on the size of the air chamber, and the amount of air in the water. Some of the chambers on a long line will collect more air than others, according to the profile of the line.

For a pipe of this size not under too great pressure, the comparative cost of iron and wood at the locality would probably settle the question of which to use, unless there were questions of soil constituents acting upon wood or iron, or variations in moisture in the soil, or difference in loss of head by friction in so long a pipe. If the fall of 9 feet per 100 extends for the whole two miles there is a difference of elevation of nearly 1,000 feet, so that this loss by friction would materially affect the rate of discharge of water. If the flow of water is cut off at the lower end, the pipe will be subjected to the total pressure due to the difference in elevation in its length and it must be strong enough to stand the 400 pounds or more per square inch which this amounts to. Will the 30 to 60 gallons a minute which a 2-inch iron pipe in poor to good condition would discharge under these conditions be sufficient supply?

Best Form of Water Works Franchise.

Will you kindly advise where I can get the best information for the requirements of a water works franchise.

A. J. MCKENZIE, City Engineer,
Webb City, Mo.

The principles stated in the editorial in MUNICIPAL ENGINEERING, vol. xxxviii, p. 335, are excellent. They are put into the form of a franchise in a paper on "A Co-operative Water Works Franchise," presented at the last meeting of the American Water Works Association by J. W. Alvord. A copy can probably be obtained from the secretary of the associa-

tion, J. M. Diven, superintendent of water works, Charleston, S. C. A similar franchise will be found in MUNICIPAL ENGINEERING, vol. xxxvi, p. 247, as prepared by D. H. Maury for another city. On p. 177 is a sketch of the provisions which are essential in a water works franchise or contract. Articles discussing principles upon which franchises should be based will be found in vol. xxxv, p. 36, and vol. xxiii, p. 166.

Methods of Testing Creosote Oil.

Will you kindly inform me whom I should address to obtain copy of Bulletin No. 65 of American Railway Engineering and Maintenance of Way Association.

E. WHITMORE, City Engineer,
Port Huron, Mich.

This bulletin can be obtained by sending fifty cents to the secretary of the American Engineering and Maintenance of Way Association, E. H. Fritch, 962 Monadnock Building, Chicago, Ill.

Who Made This Valve?

In the water system here there are a number of valves for shut off purposes. A few days ago one of them started to leak and after having it dug up for repairs I found the packing box and gland both broken, but held in place by the stud bolts. I have tried to find the maker of the valve in several catalogues but it don't seem to be listed in any of them. It s a gate valve and the size is 4-inch. The marking on the side of the valve, all in capital letters is Scott 25, 86 or 88, I could not be sure whether it is 86 or 88, but the rest of the lettering is quite plain. On the other side of the valve is the figure 4. What I would like to know is, where I can get the parts to repair the broken ones, so if you know who the makers of it are I would be glad to get into communication with them.

J. J. H., Goldfield, Cal.

Can any of our readers supply the information?

Engineer's Charge for Special Assessment Work.

I should like to ask if you can inform me as to the usual charge made by engineers for the necessary work to be done in connection with special assessment covering water service pipes, sewers and paving?

Is it customary for the engineer to bid a certain percentage of the total cost of the work; and if so, what do you consider a fair percentage?

R. H. R., Chicago, Ill.

The question is not clear. If the charge for entire engineering services is meant, reference may be made to the May number of MUNICIPAL ENGINEERING, vol. xxxviii, p. 346, for a statement of reasonable fees and considerations which might modify the fees named.

It is quite customary for engineers to name a percentage of the cost as the basis of their compensation. Occasionally, where the proceedings may be long drawn out, a modification providing for salary or payment of inspectors or assistant engineers for extra time on account of delays should be included in the agreement.

If the question refers to the process of making the special assessments for the improvements named, this is largely clerical work and is usually paid for by the day or month, a salary of say $10 to $20 a day being allowed the engineer and up to $5 a day for the clerks.

Provisions of Charter for Small City.

We are about to frame a charter for the purpose of incorporating as a city under the general act of the Michigan Legislature, enabling villages of 2,000 so to do, and I would like to get a copy of the proceedings of the seventh annual convention of the American Society for Municipal Improvements, containing a paper on city government, price $1.00. Can you supply it? Have you anything else along this line?

A. P. WEBER, Village President,
Fremont, Mich.

The volume referred to can be supplied. It contains an extensive review by F. W. Cappelen of the provisions in the charters of a number of large cities all over the world existing prior to its date, 1900. Some advance has been made in the last ten years and, also, a small city does not require so elaborate a system of government as a large city, so that there are at the present time sources of information more closely applicable to the conditions in the small city mentioned.

In the first place, a large number of executive officers is not required, but one or two competent, expert men, who can be retained during good behavior are imperatively demanded.

The commission form of government, one application of which is described in an article on "Memphis Under a City Commission," in MUNICIPAL ENGINEERING, vol. xxxviii, p. 27, has many advantages for the small city, not the least of which is the election of one member of the commission each year, so that there is no opportunity for a complete change of administration at any one time. Nominations by petition instead of by parties is another most important improvement generally introduced with the commission form of government, but just as valuable in any other form. The various methods of making nominations for office are compared and contrasted in an editorial on p. 105 of the same volume.

An article on p. 345 compares the commission form of government and the so-called federal form, with the recent modifications in Indianapolis and particularly in Boston, which incorporate the best features of the commission form and omit some of its objectionable features. It coordinates and refers to a number of prior articles discussing various details.

Particular attention is called to the municipal business manager, whose success in one city is shown in vol. xxxvi, p. 279, as one of the experts which the small

city should employ. With a salaried business manager, clerk and perhaps mayor, the two former being employes and the later one of the commissioners, the small city will be well supplied with executive officers and the commissioners can be expected to serve for merely nominal compensation if they receive any whatever.

A former mayor of Indianapolis describes the present charter of that city in an article on p. 404, vol. xxxviii.

Charges for Engineering Services Computed on Total Cost.

Will you kindly tell me through the "Question Department" what the engineer's percentage on materials used in construction is, if any, in eastern practice?
P. O. Box 12, Edmonds, Wash.

See the answer to a similar question herewith, also the answer in vol. xxxvii, p. 346. The same percentage is charged on all the items of cost of the work. The usual division of charges is on the basis of preliminary studies and plans, detailed plans and specifications, superintendence of construction and inspection, as outlined in the articles above referred to and others referred to in them. Each of the percentages is computed on the total cost of the work, including materials, labor and other necessary expenses of the work. The cost may be the estimated cost or the actual cost according to the nature of the contract with the engineer and the necessities of the case, but no difference is made between materials and other items of cost, unless there is a special contract to that effect. Much of the work of the engineer and his inspectors during construction is connected with the selection, inspection and handling of the materials and, unless the circumstances are very exceptional, there is no apparent reason for a different percentage on their cost.

Number and Cost of Electric Lights.

I am anxious to get some specific information regarding community lighting.

How many arcs or how many incandescent lights are necessary for, say, a mile of streets, and at what cost can this light be secured under normal circumstances?

What is the average rate over the country?

H. I., New York City.

The volumes of MUNICIPAL ENGINEERING are sources of much information on these questions. But one of the early results of investigation will be the conviction that each town or city is in many respects a problem to itself and that a brief study of a given town by an expert accompanied by a citizen familiar with special needs will give a more economical plan for lighting the town than any general plan cut down or expanded to suit the mileage of streets.

In vol. xxxviii is an article on "Arc and Other Electric Lights," which answers some of the question above asked. This article will repay study and will be a guide to a close study of the problem of relative cost of various kinds of electric lights.

The average cost of electric light throughout the country is not far from the figures stated in the article for particular cases, viz: $80 a year per open arc lamp, $56 per enclosed arc lamp, $47 per magnetite lamp, doing somewhere near the same service, and $22 per 60-cp. tungsten lamp doing perhaps one-third the service. Incandescent carbon filament lamps are also used at prices which, when enough lamps are used to perform the same service, amounts on the whole to about the same total.

On pp. 107 and 186 of the same volume are lists of previous articles answering the questions in more or less detail.

The proper method of determining the cost of and the charges for electric lighting is set forth in the article on p. 108. Two good articles will be found on pp. 166 and 169, the former on "The Tungsten Lamp and Its Relations to Central Stations" and the later on "Central Stations for Towns of 1,000 Population." The latter article assumes 5 arc lights and 60 60-watt series incandescent lamps as the requirements for street lighting in a town of this population. On p. 187 is a long list of cities giving population, number of street lights, rates for the same and cost of plant.

The lighting plant of Thomasville, Ga., is inventoried on p. 249, and on the same page is "A Comparison of Cost and Efficiency of Methods of Street Lighting," which compares the results with open arc and luminous arc lamps, with carbon, gem and tungsten filament lamps.

On p. 330 is an article on "Rate for Tungsten Street Lamps" in one of the tables of which is shown a variation in rate for 40-c. p. lamps from $14.40 to $25 a year and in 60-c.p. lamps from $17.50 to $23.40 a year.

On p. 393 is an article on "Factors That Should be Considered in Making Street Lighting Contracts." Some figures of rates for one city and comparisons with other rates are given in articles on p. 417.

All of these articles are in one volume, six months, and show the practical value of MUNICIPAL ENGINEERING as a source of information for such studies as this.

The recently issued volume of "Statistics of Cities Having a Population of Over 30,000; 1907" compiled by the U. S. Census Bureau, gives data for the answers in a general way of the above questions, but they may be very misleading if proper allowance is not made for differences in local conditions. Thus the number of arc lights used per 100 miles of street varies from 14.1 in Sioux City, Iowa, to 1,382.8 in York, Pa. Of the cities reported 76 use more than 350 arc lights per 100 miles of street and 82 use

less than 350. Fifteen cities with population over 300,000 average 385.6 arc lights per 100 miles of street. Twenty-nine cities between 100,000 and 300,000 average 291.2; forty-seven between 50,000 and 100,000 average 327.3; and 67 between 30,000 and 50,000 average 252.6.

The reports concerning use of incandescent lights are very scattering and quite as variable. The number of lamps per 100 miles of street, varies from 0.8 in Dubuque, Iowa, to 1,876 in Malden, Mass. In cities of over 300,000 population the variation is from 1.8 to 411.6 and the average of the 6 cities reported is 50.6. In 10 cities of 100,000 to 300,000 population the variation is from 10.7 to 944.7 and the average is 144.5. In 29 cities of 50,000 to 100,000 population the variation is from 5.4 to 1,138.3 and the average 154.1. In 31 cities of 30,000 to 50,000 population the variation is from 0.8 to 1,876.0 and the average is 95.8. Thirty-four cities use more than 150 lamps per 100 miles of street and 43 cities use less. It is evident that in neither case, incandescent or arc lights, do these figures give any indication as to how many lights should be used per mile of street, and the returns probably do not give the information really wanted, although they may answer the question asked in the blank.

There are but few reports of prices paid per lamp included in the tables. In the cities of over 300,000 population the prices for open arc lamps in 3 cities reported vary from $63.83 in Baltimore to $100.06 in Philadelphia per lamp per year; for enclosed are lamps in 13 cities from $52.93 for part of the lights in Chicago municipal plants to $130 for a part of the New York city lights; for incandescent lamps in 5 cities from $9.15 in San Francisco to $31.28 in Boston per lamp per year, with a few lamps in Washington running from $41.25 to $65.

In cities of 100,000 to 300,000 population the prices paid for open arc lamps in 9 cities reported vary from $45 in Toledo, O., to $104.75 in Providence, R. I.; for enclosed arc lamps in 20 cities from $48.80 in Nashville, Tenn., to $86 in St. Paul, Minn.; for incandescent lamps in 9 cites from $4.22 in Los Angeles, Cal., to $28 in Denver, Col., and Atlanta, Ga.

In cities of 50,000 to 100,000 population the prices paid for open arc lamps in 14 cities reported vary from $60.22, with a few lamps at half price, in Schenectady, N. Y., to $100 in Hoboken, N. J.; for enclosed arc lamps in 34 cities from $47 in Harrisburg, Pa., to $105 in Somerville, Mass.; for incandescent lamps in 28 cities from about $5 average in Oakland, Cal., to $36 in Savannah, Ga.

In cities of 30,000 to 50,000 population the prices paid for open arc lamps in 15 cities reported vary from $55 in Bay City, Mich., to $120 in Woonsocket, R. I.; for enclosed arc lamps in 55 cities from $19.65 in Taunton, Mass., to about $114 in San Juan, Porto Rico, and $112 in Butte, Mont., and Pawtucket, R. I.; for incandescent lamps in 29 cities from $2.75 in Taunton, Mass., to $34 in Auburn, N. Y.

A few cities report lamps paid for at more than one price. Taking the prices in all the cities in the list, 23 of the prices for open arc lamps are $80 or more per lamp per year and 27 are less; 76 of the prices for enclosed arc lamps are $70 or more per lamp per year and 70 are less; 49 of the prices for incandescent lamps are $20 or more per lamp per year and 41 are less. These mid prices are not far from the averages for the country, being probably a little higher than the averages for the respective kinds of lamps.

Sewage Purification by Irrigation.

I am desirous of obtaining some information on the advisability of installing septic tanks in a town of 5,000 inhabitants, located in a fertile valley some distance from good sand and gravel, the necessary ingredients to a purification plant. From the information I have at hand septic tanks are an expensive proposition and not altogether a success. On the other hand ranch land can be purchased quite reasonably, and I think the necessary pipe (24-inch or 30-inch concrete) to carry the sewage a mile and a half to a favorable location for a sewer farm would not amount to any more, if as much, as a purification plant nearer to town. Good sand or gravel costs from $2.00 to $3.00 per yard, and crushed rock about $4.00 delivered. The pipe would cost about $3.00 per ft. laid. Under ordinary conditions am I not right? I should appreciate your opinion. I should presume a sewer farm to be the most economical form of sewage disposal.

H. H. M., ———, Nev.

Where irrigation is practical it would seem to be most economical, in the broad sense of that term, to use sewage for irrigation, both because it adds to the supply of water for this purpose and because there is a certain amount of matter in the sewage which serves as a fertilizer. There are some practical difficulties which have prevented entire satisfaction in all respects in such cities as Los Angeles and Pasadena, which have used this method of sewage disposal to some extent, but for a small city these difficulties can be overcome readily and the success should be more pronounced.

Even if the sewage effluent is not used for broad irrigation it should be possible, unless the soil is more than usually impervious, to use it for filtration purposes, with as many changes of filtration area as the circumstances of the case require.

Which method would be the best can only be determined by a careful study of the exact conditions on the ground.

Assuming, as is probably the case, that irrigation is the best system to adopt, it will be necessary to provide a settling and screening tank to remove all solid matters of size and kind such as would interfere with the passage of the water into the soil, and as would give rise to nui-

sance by clogging the surface and there decomposing. In a properly designed tank all of this matter except paper, sticks, rags, and the like, will be liquefied during the passage of the sewage through it, so that the solid matter to be disposed of at the screens can be handled without nuisance.

Unless a rotation of fields and crops can be established which will take the sewage effluent as it flows from the tank every day and all day, it will be necessary to set aside one plot where sewage disposal is considered more important than the crop, on which the sewage may be turned when there is no crop ready to receive it without damage.

The size of the tank, the number and area of the plots of ground to receive the sewage, etc., must be determined with reference to the amount of sewage at present to be disposed of and the probable growth of the town. The amount from a town of 5,000 people is small enough to be handled easily and without nuisance. Evidently it will require constant care, but not much more than the irrigation and cultivation of the land requiring the same amount of clean water.

The supposed high value of the sewage as fertilizer has heretofore suggested its use in irrigating garden crops, especially in climates where the gardens can be kept growing nearly all the year round, but some prejudice against this class of crops was aroused by some of the observations made of the method of handling them at Los Angeles and Pasadena, and the consequent fear of the distribution of contagion by means of the vegetables in case the sewage were infected with germs of disease. English walnuts have been commended as an excellent crop for sewage farming, in view of their growth on trees, the impervious shells, and the antiseptic result of the usual bleaching of the nuts before sending them to market. Alfalfa, and other forage crops, fruit and other trees, would also promise well as safe crops, and the writer believes that reasonably sanitary care of vegetable crops would render them perfectly safe.

Lists of articles on the septic tank to be found in the volumes of MUNICIPAL ENGINEERING, will be found in vol. xxxvii, p. 241; vol. xxxiii, p. 249, and vol. xxxi, p. 280. Since the latest of the above lists the following have appeared:

In vol. xxxvi: "Best Method of Purifying Sewage," p. 238; "Method of Sewage Disposal," p. 362.

In vol. xxxvii: "The Sludge Problem in Sewage Purification," pp. 19 and 40; "Status of Sewage Disposal in America," p. 80; "Cost of Disposal Plant," p. 106; "Agriculture on a Sewage Filter," p. 105; "Sewage Disposal Plants and Stream Pollution," p. 119; "The Cesspool and its Dangers," p. 240; "Disinfection of Sewage and Sewage Effluents," p. 365.

In vol. xxxviii: "Cost of Septic Tank," p. 40; "Information About Cameron Patents on Sewage Purification Processes," p. 192; "Sewage Purification for the City of Dresden, Germany," p. 248; "Information About Sewage Disposal," p. 346; "Effect of Sewage and Sewage Gases on Concrete," p. 390.

There is a brief article on the "Profits of the Pasadena Sewer Farm" in vol. xxiv, p. 54.

Covers for Septic Tanks.

What sort of material is the better for covers over septic tanks?

IRWIN H. ALTHOUSE, City Engineer,
Porterville, Cal.

This is largely a question of expediency. A wooden cover will answer every purpose so far as the tanks themselves are concerned. If the span of the roof is not too great, concrete beams and slabs will be satisfactory and not too expensive. Recent experiments on the effect of sewage on concrete reported in the June number of MUNICIPAL ENGINEERINNG and in this July number, show that the gases formed in a septic tank do not act injuriously upon concrete. There are, however, one or two reports of slight deterioration from sewage gases where there was no ventilation, so that it would be safest to insure thorough ventilation or to paint the concrete with a substance not acted upon by sulphuretted hydrogen. In a climate with great virations in temperature there should be provision for expansion and contraction in the concrete without danger of cracks. The concrete beams would doubtless be reinforced and the slabs may be also if desired.

Steel trusses may be used to support the roof if they are kept painted so that the gases from the sewage will not act on the metal.

If first cost has a large influence in making the decision, wood will probably carry the day. Concrete will be most permanent; and if wood is expensive and concrete materials are cheap, it may easily be more economical in the long run to use concrete.

From these considerations a choice can be made by one who is familiar with the local prices of materials and the local conditions.

Information About Garbage Destruction.

The city contemplates erecting a garbage incinerator. I desire as much information as possible on this subject, and shall appreciate it if you will refer me to such books, papers and literature on the subject as I may be able to procure. The city has a population of about 15,000 of which garbage will have to be taken care of.

G. H. L., ———, N. D.

Morse's "The Collection and Disposal of Municipal Waste" ($5) is the fullest single source of information available. It gives data about nearly or quite all the garbage disposal plants in the United States, and about many in other countries.

Venables' "Garbage Crematories in America" ($2) describes the cremation furnace for garbage and other city refuse and Parsons' "Disposal of Municipal Refuse" ($2) is devoted mainly to refuse disposal as distinguished from garbage destruction.

Branch's "Heat and Light from Municipal and Other Waste" ($3) is devoted to the utilization of the heat from refuse and garbage destruction, mainly by a single system.

There are two good English books, mainly describing high temperature garbage destruction. They are Goodrich's "Disposal of Town Refuse" ($3.50) and his "Refuse Disposal and Power Production" ($5), the latter describing the numerous English types of plant where the heat generated by the destruction of the garbage and refuse is utilized for the production of power.

Several plants for the incineration of garbage are described in MUNICIPAL ENGINEERING.

Particular attention is called to the series of papers on "Town Scavenging and Refuse Disposal, now appearing. These articles take up all parts of the subject from the collection of the garbage and refuse to the utilization of the heat and the clinker from the garbage furnace. They began in November, 1909, vol. xxxvii, p. 287, and are not yet completed.

A furnace for a small city, such as the one referred to in the question, is described in vol. xxxviii, p. 63. The problem of garbage collection is briefly discussed in vol. xxxviii, p. 194 and in vol. xxxvii, p. 36 will be found a list of previous articles on this subject. An abstract of a commission report on the collection and disposal of Boston refuse will be found in vol. xxxviii, p. 209. There is an article by Mr. Morse on "High Temperature Garbage and Refuse Destructors on p. 258, and a list of previous articles on p. 422 of the same volume.

Brief discussions of various details with lists of previous articles will be found in vol. xxxvii, p. 36 and vol. xxxv, p. 179. The following are not included in these lists: The New Orleans plans for garbage collection and disposal are given in vol. xxxvii, p. 49, with some practical hints on the handling of details. Odorless carts are described in detail in vol. xxxvii, p. 129. A full description of an English refuse destructor and power generating plant will be found in vol. xxxvi, p. 253.

The following good articles will be found in vol. xxxvi: "The Chicago Underground Railway System of Refuse Disposal," p. 21; "Refuse Destruction in Richmond Borough, New York City," p. 359, giving an illustrated description of the new high-temperature destruction plant for a district of 26,000 population; "Disposal of Municipal Refuse in the United States," p. 376, a review of a series of papers on the subject by a number of experts; a brief description of the use of "Garbage and Refuse as Fuel in Nottingham, Eng.," on p. 394.

Sewers on the Franchise Plan.

We have a client who is figuring on getting a franchise for a sewerage system in a town of about four thousand people. Will you let us know where we can get some data regarding rates, etc., for privately owned sewerage systems?

My recollection is, there are about a half dozen so owned in the United States, which no doubt you know of.

J. Z. G., Memphis, Tenn.

In MUNICIPAL ENGINEERING, vol. xi, p. 372, is a brief statement of the provisions of the city ordinance of Telluride, Col., fixing the rates and terms for use of a private system of sewers. The rates seem rather high, if the use of the system is general, being $1 a month for residence of 4 rooms or less, increasing to $1.50 for 8 rooms or more, $5 for hotels, $3 for laundries and saloons, 2 cents per scholar for schools, etc., all per month.

The Atlantic City, N. J., Sewerage Company, vol. xxii, p. 94, formerly charged 75 cents per room per year, with shops, stores and offices $4 a year each. This company is now disposing of the sewage of the city as a whole.

The Asbury Park, N. J., Sewer Works, see the same article, charged from $30 to $75 for making connections and $5.50 to $10 per year rental for store or regular sized dwelling, and $25 to $50 a year for hotels.

New Orleans formerly had a sewer company, see vol. xxii, pp. 253 and 397, but it is now entirely superseded by a municipal system. The terms of the franchise are discussed in vol. x, p. 417, and vol. xiii, p. 93.

Shelbyville, Ind., had five private sewer companies, each really in the nature of a partnership to build a sewer line for the benefit of the partners, but admitting others along the line on payment of agreed sums. These will shortly be connected with the city system, now under construction and will then become a part of it. Columbus, Neb., Newton, Kan., McKinney,, Tex., are cities having similar private sewers.

Long Branch, N. J., formerly had a private sewer system which is now operated by the municipality.

Natchez, Miss., Shreveport, La., Toronto, O., have granted franchises to sewer companies in the past. The tendency in all the cases named is toward assumption of the plants by the city. Thus Vincennes, Ind., has secured plans for sewer systems at various times, but has not yet constructed them, and a contractor under an agreement with the county put in a sewer to serve the courthouse and is charging residents and stores along the line rental for using the sewer. It is possible that at some time in the future

the council can agree to build a municipal system on the lines of some one of its numerous plans, in which case the private sewer company will probably cease operations.

The supreme court of Colorado stopped the operation of private sewer companies in that state by a decision that the city had no right to grant a franchise for such purpose. See abstract of decision in vol. xxiv, p. 201.

The city of New Albany, Ind., secured the passage of an act to authorize construction of sewers by a private company, but finally constructed a system at public cost. See vol. xxiv, p. 138.

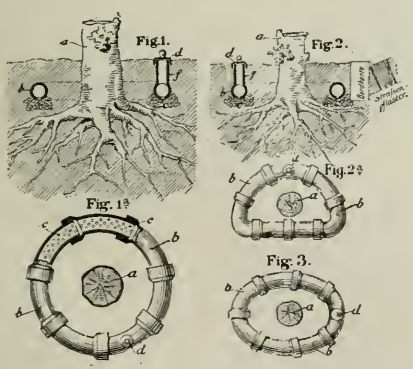
FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Supplying Water to Trees in Street Lawns.

A communication in *Tonindustrie-Zeitung* describes and illustrates a method of supplying water and fertilizer to trees in such restricted spaces as the lawns of streets, paved areas, small yards and the like. As shown by the accompanying cut, reproduced from a German periodical, a pipe ring is laid entirely round the tree, the pipe used being of form to fit the locality the best. This pipe, which may be of any suitable material, is perforated on the bottom, and is laid in a bed of gravel or slag. From one of the lengths of pipe a T extends to the surface, where it may be capped. The water or liquid fertilizer is introduced into this T and so reaches all sides of the tree.



A single test on a large number of trees in one locality proved very successful, but the expense is probably too great to make the use of the device general. It should, however, be of much value in the special cases mentioned above.

If the gravel bed drains the water away from the pipe promptly there should be little or no trouble from roots growing into the pipe and filling it.

Effect of Sewage and Sewage Gases on Portland Cement Concrete.

The paper on the above subject, an abstract of which was printed in the June number of MUNICIPAL ENGINEERING, was quite fully discussed at the meeting of the Concrete Institute at which it was presented by its author, Mr. Sidney H. Chambers, and the following points of interest were brought out, as reported in *The Surveyor and Municipal and County Engineer.*

Mr. Edwin Ault referred to a case which appeared to corroborate that of the author. They had had occasion to report on the corrosion of certain concrete pipes used in a tropical city for the carriage of sewerage. The pipes were made with good cement and clean, sharp sand, and were 4 in. internal diameter, more than ¾ in. in thickness, and of high quality. Corrosion appeared only in the upper aerial parts, while the portions of the pipes covered by the sewage were found to be unaffected. Analysis of the incrustation showed the presence of sulphur, and, bearing in mind the rapidity of the decomposition of organic matters in the tropics and the great humidity of the ordinary atmosphere of this particular city, as well as that the sewage was a domestic one of great strength, he had not the slightest doubt that the corrosion was due to the same cause as that experienced by Mr. Chambers.

Mr. D. B. Butler mentioned a similar case of a piece of concrete pipe from the tropics, his conclusion being that the

coating on the pipe was largely sulphate of lime, and that the disintegraton was due to corrosion from the sulphuretted hydrogen from the sewage. From experiments that he made with cement briquettes he found that the part immersed in solution did not appear to be affected, while the part in the sulphuretted hydrogen gas was disintegrated in four or five days. It appeared to be entirely a matter of ventilation, and if a pipe were so ventilated as to avoid the gas disintegration would not occur.

Mr. A. C. James (Grays Thurrock) said he had to deal with a very strong sewage, and practically all the tanks and works through which the sewage passed were formed of concrete. Owing to the flat nature of the district the flow was slow, and the sewage when it reached the works was very concentrated and in a septic condition. The sewage flowed into two uncovered receiving chambers formed of Thames ballast and cement, 4 to 1 concrete, but after fifteen or sixteen years' use these were still absolutely sound. The septic tanks were of concrete, and there was no sign of disintegration in these. Bad foundation had resulted in considerable cracking of the tanks, and it had been necessary to cut into the walls for the purpose of repairs. The walls were therefore in a condition which would render attack easy, but there was still no sign of any action having taken place. His suggestion was that there must be something in the material of which the Hampton concrete was made that was really responsible for the trouble that had taken place.

Mr. W. Kirkcaldy said he did not entertain much doubt as to sulphur being the cause of the disintegration. They should endeavor to get the concrete as dense as possible. Perhaps, also, in special circumstances it might be possible to find some coating.

Mr. E. P. Wells stated that from his experience he found they got the greatest amount of sulphur in London in the neighborhood of cookshops. Wherever a large quantity of cabbage water was discharged they found it highly charged with sulphuretted hydrogen, so that, under those circumstances, if the sewage at Hampton were allowed to rest for some time a considerable generation of gas would result.

Mr. A. Roechling said he considered that no alarm need be felt by those who had been using concrete tubes in connection with the disposal of sewage, because the conclusions of the author limited the subject to one particular point—namely, that of very foul or putrid sewage. Whenever there was a chance of the formation of sulphurous acid—which he was inclined to think was the active agent in disintegration—they should avoid using concrete. There were certain conditions under which the use of concrete tubes was inadvisable, but these were exceptional and extreme conditions. For example, when they had very hot sewage discharging into a sewer they should not be employed, because the hot sewage set up an action which led to cracks and which, no doubt in many cases, resulted in the collapse of the tubes. Further, they should avoid using concrete which came in direct contact with acids. He had examined septic tanks and cesspits which had been in use for a number of years, and found the cement rendering practically intact, and he put it to Mr. Chambers whether this was due to the absence of free air. At Hampton they had artificial ventilation, and it might be owing to that that oxidisation of the sulphuretted hydrogen proceeded more rapidly and effectively. Concrete was a very suitable material for sewerage or sewage disposal purposes, but those who used it should bear in mind, under certain conditions, it might lead to disaster.

Mr. Arthur E. Collins, city engineer of Norwich, in a communication on the subject of the paper, stated that there were some concrete sewers in Norwich which were laid in 1891, and which varied in internal diameter from 42 in. to 22 in., their total length amounting to several miles. These sewers were first used for the carriage of sewage about twelve years ago, and showed no signs whatever of disintegration. The main outfall discharged into a pair of concrete tanks forming screening chambers, and the concrete in these had not deteriorated. The sewage passing through the screens was pumped into the sewage farm, where for nearly forty years it had been conveyed into an open concrete carrier, and no disintegration had taken place there. His attention was called a few years ago to a reservoir in East Anglia in which bricks from the Peterborough district were used, and in that case the mortar was disintegrated; this, he was informed, being due to the presence of sulphur in the bricks. He was consulted on one occasion with reference to the failure of some brickwork which was supposed to be laid in cement mortar, but which, about twelve months after construction, collapsed. An analytical chemist who was consulted reported the presence of a large amount of sulphur, and in that case also it appeared that the sulphur came from the bricks, which were likewise from the Peterborough district.

Mr. H. K. G. Bamber, F. I. C., in another communication, said he agreed with Mr. Chambers that the probable cause of the defects was the action of sulphur compound, although there might be some doubt as to the precise action which took place. His belief was that a fairly warm temperature and a moist atmosphere were necessary to produce the results which had been shown. The remedy seemed to be the formation of an absolutely impervious and smooth surface.

Useful Notices to Water Users.

To the Editor of MUNICIPAL ENGINEERING:

Sir—I am enclosing copies of two cards that this department is using, thinking that they might be instructive to some of the many people interested in the same line of business.

The postal notices we have used since June, 1906, and up to this date have sent out nearly 15,000 of them. Every card is numbered in the left hand upper corner and a record of this with the meter readings and account number is kept in a book provided for the purpose.

We find this notice has been very well received by the patrons and has saved the department a great deal of annoyance from complaints and saved them large water bills. We have over 15,000 meter accounts and during our annual collections in Nov., 1909, we made less than 25 reductions on acount of large consumption.

The red card (second below) is one just got out and they are being distributed by the meter readers this month. Our

patrons, as a whole, seem to be glad to get the information.

J. M. WISLER, Superintendent
Water Works Department,
Toledo, O.

BOARD OF PUBLIC SERVICE.
Toledo Water Works Dept.

Toledo, Ohio,.....191..

.....

Our meter reader reports an unusually large consumption of water at.....
You must have a waste of water or leak. Please investigate, and have repairs made, otherwise you will have a large water bill.
Yours truly,
J. M. WISLER, Supt.

To the Patrons of the
of the
TOLEDO WATER WORKS

It is quite important that all meter users know how to read a meter, in order to keep posted as to the amount of water they are using and to verify the meter reader's reading, and for this pupose you will find on the opposite side of this card a meter register with the information how to read it.

Residence meter bills are payable on or before May and November 10th. These bills can be paid, by mail, with bank draft or check, postal or express money order, which will save a great many of our patrons' time and inconvenience. The different express companies and the post-office have about 80 branches where these orders can be procured at a very small cost. Have them made payable to the Toledo Water Works and enclose them with your bill in an envelope with a two cent stamp on it, and we will return the bill properly receipted.

Quite a number of our patrons are using water motor washing machines and water motor soft water pumps.

A motor washing machine requires from six to ten cents worth of water to operate per hour. Soft water motors will use an excess amount of water unless kept in good repair.

You can detect a leak in your fixtures by carefully watching the one foot hand on your meter dial, when there is no water being used, and if the hand moves it indicates that you have a leaky fixture and it should be repaired at once.

TOLEDO WATER WORKS.
Both 'Phones, Main 141.

READING
WATER METER REGISTERS

(Here appears a cut of the register of the meter.)

Numbers over the circles indicate the amount of one revolution of the pointers. The one foot circle is used only for testing and detection of small flows of water, and is not considered in service reading.

The usual method of reading is as follows: Disregard the one foot circle. Commence with the ten foot circle and read each higher one consecutively, putting down the figures in the same order, always taking the lower of the two figures between which the pointer stands. When the pointer is so near a figure as to apparently indicate it exactly, refer to the the next lower circle, and if that pointer has passed the "0" the figure indicated is correct; otherwise take the next lower.

In the example shown the reading of the "10" circle is 4; of the "100" circle, 3; "1,000" is 9; the "10,000" circle indicates 6; and the last, or "100,000," is 8, thus making the correct reading 86,934 cubic feet.

The above register is in cubic feet and the readings should be multiplied by 7½ to show the number of gallons.

Vitrified Pipe Line Under Pressure.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Referring to the article on "Water Tight Joints for Vitrified Pipe," p. 265 of the April number, we report the following:

A pipe line for carrying water, made of sewer pipe, was laid in connection with the waterworks of Hobart, Okla. This line is about three miles long and has in this distance a fall of twenty-four feet. It was laid to conduct water from springs to the municipal pumping plant, and passes under creek beds and over some small hills, following the natural slope of the ground, and at several points is subjected to static pressure of about fourteen pounds. It has two valve openings at its upper end, one 4-inch and one 8-inch. The flow of water is regulated at these upper openings by an employee who resides a short distance from the springs. At the lower end the pipe line discharges freely into an open reservoir, from which point it flows to the pump. The conduit has been in use for about four years, and is said to have given perfect satisfaction.

The line is composed of 12-inch vitrified pipe, double strength, furnished by the W. D. Dickey Clay Manufacturing Company of Kansas City, who used special care in selceting the pipe for this line. The pipe was furnished in lengths of 2½ feet and sockets 3 inches deep; sockets and spigots both being corrugated. It was provided in the specifications that at least four joints should be made with the pipe standing vertical in the trench, and that it should then be carefully lowered and the joints connecting these sections be made in the trench. The joints were made by taking a roll of U. S. Navy oakum and calking it into the joint, using proper calking tools to drive the gasket into place and care being taken that the space was entirely closed, to prevent the liquid from running into the pipe. The jointing material was composed of a mixture of one-third pure asphalt, one-third crude asphalt and one-third petroleum, with a little granulated lime added to stiffen the mixture, which was heated to about 200 deg. and then poured into the joints. The joints made in the trench were poured by the use of a clay roll similar to that used in lead joint construction.

Experiments on the jointing material were made during one winter, the pipes being subjected to a freezing temperature and then to a temperature of about 130 deg.; the joints being subjected to a water pressure of thirty-four pounds to the square inch during these experiments without showing any leakage.

The cost of the pipe line laid complete was 72 cents per lineal foot. The contract

was let in combination with the rest of the waterworks plant, and other bids for this particular item were received as low as 54 cents per lineal foot. The cost of the work shows a considerable saving over any other material known which would secure satisfactory results. The surveys, plans and specifications for this work were made by us and were submitted to the Interior Department of the United States for approval, which was given them and the construction was supervised by the engineers of the United States Geological Survey.

BURNS & MCDONNELL, Civil Engineers,
Kansas City, Mo.

MUNICIPAL MATTERS IN COURT

Higher Courts—Board of Health vs. Sewer System—City Pays Deficit—Cincinnati Wood Block Paving—Texas Drainage Law—Damage for Inadequate Service—Omaha Water Works Purchase—Asheville Paving Assessments—Kansas Dike Assessment—Drain for Street Improvement—Viaduct Maintenance by Railway—Macadamizing Is Repairing.

Decisions of the Higher Courts of Interest to Municipalities.

Special Assessments — Regularity of Proceedings.—To recover an assessment for public improvements, only a substantian compliance with the law is required. —City of Salem ex rel Roney et al v. Young (Mo.) 125 S. W. 857

Construction of Sidewalks — Notice of Owner.—Where a property owner attended a meeting of the board of aldermen at which an ordinance condemning a sidewalk adjacent to his property was passed and requiring the construction of a new sidewalk, and then notified the city that he would not pay for the construction of a new walk, he thereby waived the right to formal notice of the proceedings and cannot set up want of such notice as a defense to a suit on tax bills; the object of notice being merely to allow the owner to make any objections to the proceedings or to build the sidewalk himself.—Idem.

Extension of City Boundaries Over Unplatted Land.—Under Rev. St. 1879, sec. 4932, authorizing the mayor and board of aldermen of a fourth-class city, with the consent of the majority of the qualified voters, to extend the city limits over any adjacent territory, such a city could extend the city limits over unplatted adjacent territory.—Idem.

Water Supply by Water Company—Rights of Consumers.—The business of a company furnishing water to the public is naturally monopolistic, and, being given the power of eminent domain to serve the needs of the public more effectually, its business is affected with a public use, and it must serve all consumers with equal facilities and without discrimination.—State ex rel. Ferguson v. Birmingham Water Works Co. (Ala.) 51 S. 354.

Public Water Supply by Water Company—Discrimination in Rates.—If a rate to favored customers of a water company is less than the reasonable rate it may lawfully demand from all on a basis of uniformity, the discrimination is at the company's expense, and does not impinge on any right of consumers generally, and the granting of a rate to a considerable number of consumers more favorable than the rate fixed for consumers generally in absence of justification would be evidential that the general rate is so unreasonable as to call for municipal or legislative revision within constitutional limitations, but making a concession to a consumer does not fix a new schedule of rates for all according therewith.—Idem.

Water Company — Discrimination in Charges — Indictment — Revocation of Franchise.—If within the limit of rates fixed by an ordinance-contract and by its right to a reasonable compensation a water company capriciously and oppressively, for ulterior and unlawful purposes, discriminates so as to wrong and injure consumers, it would plainly abuse its franchise, and the inquiry in such a case would be as to whether it might not be punished by indictment or process to revoke or annul its franchise.—Idem.

Municipal Corporations — Unauthorized Expenditures—Partial Invalidity.—Where the primary object of a public expenditure is to subserve a public municipal purpose, the expenditure is legal, though it also incidentally involves an expense

which, standing alone, is unlawful, but where the primary object is not to subserve a public municipal purpose, but to promote a private end, the expenditure is illegal, though it may incidentally serve a public purpose.—Brooks v. Incorporated Town of Brooklyn et al. (Iowa) 124 N. W. 868.

Municipal Corporations—Powers—Erection of Buildings.—An incorporated city situated in a farming community with a population of 1,200, has no power to erect a city building designed for an opera house with an auditorium, box office, ticket window, stage, balcony, dressing rooms, etc., though of the floor space of about 6,000 square feet, 1,200 square feet is to be used by the city government for offices, fire department, etc.—Idem.

Public Improvements — Assessments — Effect of Condemnation Proceedings.—The constitution, forbidding the taking of private property for public use without compensation, necessitates the ascertaining of the compensation and the levy and collection of an assessment to pay the cost of property taken by a city for the improvement of a street, before any work on the improvement of the street is performed, and Laws 1905, c. 55, authorizing cities to condemn land for public use, is designed solely to ascertain and assess the compensation; and hence a city acquiring land for widening and regrading a street may order the improvement of the street and levy an assessment to pay the cost thereof under its charter provisions, and need not levy the assessment in the condemnation proceedings—Brown et al v. City of Seattle (Wash.) 106 Pac. 1113.

Water Works Company—Effect of Expiration of Franchise.—On the expiration of a water company's franchise by limitation, the company's right to operate its plant and use the streets of the city therefor ceased, and with it the right of the city to demand service.

Where, after the expiration of a water company's franchise, it continued to operate its plant and render service to the public, it was bound during such period to perform the obligations growing out of such assumed quasi public service, to the extent that it was required to supply water adequate to its reasonable capacity and at reasonable rates, and to that extent it was subject to the jurisdiction of the courts to enforce its implied undertaking. Where the water company, after the termination of its franchise, continued to furnish water, it did so according to a quasi contractual relation, which was a mere license from which either it or the city could withdraw at will.—Laighton v. City of Carthage (Mo.) 175 Fed. 145.

Termination of Franchise—Removal of Water Company's Plant—Interference by City.—Where, after considerable litigation between a water company, whose franchise had expired, and the city, the water company, which was doing business at a loss, deeded its property to a mortgagee to save foreclosure expenses, and it appeared that the city intended to carry out its purpose to keep the waterworks plant in operation until such time as it could complete its own independent plant, though complainant was desirous of removing his property, he was entitled to an injunction restraining the city's officers from interfering, by suit or otherwise, with his employes in removing his pipes and appliances from the city's streets.—Idem.

Negligence—Construction of Structures—Liability to Subcontractors.—Where defendant, a subcontractor for concrete piers of a bridge, so negligently constructed the same, with knowledge that plaintiff, an independent subcontractor for the iron work, would necessarily place heavy valuable material and tools thereon, that one of them disintegrated and fell, causing damage to plaintiff's material and tools, and the defects in the piers were not known to plaintiff and could not have been ascertained by careful inspection, and defendant knew of the unsafe condition, defendant was liable for the injuries sustained, though there was no contractual relation between plaintiff and defendant.—Pennsylvania Steel Co. v. Elmore & Hamilton Contracting Co. (N. Y.) 175 Fed. 176.

Street Improvements—Use of Patented Material.—Where the mayor and council of a city of the first class pass a resolution stating the material to be used in certain street improvements shall be "Hassam pavement," a patented material or process, and the notice to contractors published pursuant to said resolution contains a statement that the owner of all patents and process covering the laying of such Hassam pavement will furnish to any bidder to whom the contract may be awarded the right to lay said pavement, and furnish to such bidder an expert to give proper advice as to the laying thereof, at a stipulated price, and a written offer by said owner to this effect is on file in the office of the city clerk during all the time said notice is being published and up to the time a contract for doing said work is let, such contract involving in its execution the use of such patented material or process is not invalid in the absence of actual fraud or deception.—Reed v. Rockliff-Gibson Construction Co. et al. (Okla.) 107 Pac. 168.

Streets — Extent of Easement — Rights of Abutting Owners.—Where a person owns land across which a street has been constructed, he owns the fee simple of the highway, subject only to the public easement, which extends, not only to the use of the surface for purposes of passage, but also to the portion which lies beneath the surface wherever it is needed for water, sewer, or gas pipes, or any other legitimate street use.

In the absence of an ordinance or

statute prohibiting it, an owner of the fee of the bed of a street had the right, without a permit from any one, to lay pipes across and under the street, so long as such pipes did not unduly interfere with public travel or with the subsurface use to which the street as such was subject.—City of Bayonne et al. v. Borough of North Arlington (N. J.) 75 Atl. 558.

Streets — Establishment of Grade.—Where a street grade was established and an abutting owner improved her property without reference to the grade before the street was actually lowered to the grade established, she was not entitled to damages to her property by the subsequent lowering of the street to the established grade.—Collins v. City of Iowa Falls (Ia.) 125 N. W. 226.

Public Improvements — Power to Take Bond from Contractor.—Municipal corporations of this state are authorized by statute to take from contractors for public improvements bonds to secure those who furnish labor or materials towards the completion of the contract.

A bond so executed and properly conditioned, but in which the penalty is less than the amount required by the statute, is valid, and one who is unpaid for work or material furnished by him pursuant to the contract may maintain an action upon the bond.—Waterous Engine Works Co. v. Village of Clinton (Minn.) 125 N. W. 270.

Power of Municipality to Erect Building in Street.—A city possessed of the powers of controlling the streets, and also of establishing, controlling and regulating market places, cannot, in exercise of the latter power, authorize by ordinance the erection of a brick building to be used as a market place in the center of a dedicated street, since, where land had been dedicated to public use as a street, it cannot be diverted from that use.—Peters et al. Market Comrs. v. City of St. Louis (Mo.) 125 S. W. 1134.

Kansas State Board of Health Seeks to Enjoin Use of Sewerage System.

Suit was filed in the district court, June 4, to enjoin Garnett, Kan., from further allowing the present sewerage system to be used and to abate the system as a nuisance. The complaint was made by Professor Hoad, of the state board of health.

City Must Pay Deficit When Sewer Assessments Are Reduced.

Indianapolis, Ind., will have to pay from its general fund $20,000 to the American Construction Company, as a part of the cost of building the East Michigan Street sewer, according to a ruling by Judge Charles Remster, of the circuit court. The sewer was completed in 1909, at a contract price of $152,000. The city assessment bureau assessed benefits for the amount which affected a large extent of real estate in the eastern part of the city, much of which was unplatted farm land.

Appeals were made to the superior court for a reappraisement, and appraisers appointed by the courts reduced the benefit in the amount of $20,000. As the courts approved this amount of reduction, the property owners did not have to pay the $20,000, and the construction company brought suit in the circuit court against the city of Indianapolis for that amount. The city demurred on the ground that it could not be liable under the law for the payment of more than $5,000 under such circumstances. Judge Remster held that since the reduction by the court appraisers could not have been anticipated by the contractor and the city, the city was liable for that amount.

Injunction Refused in Cincinnati Wood Block Paving Case.

The application of the United States Wood Preserving Company for an injunction against the officials of the city of Cincinnati, to prevent them from permitting A. J. Henkel & Brother to carry out a contract awarded them for the repaving of Reading Road, was denied, June 4, by Judge Howard Hollister.

The plaintiff contended that, although its bid was over $12,000 lower than the Henkel bid, it was not awarded the contract owing to a scheme to give the contract to A. J. Henkel & Bro.; that in accordance with the proposals advertised for the plaintiff submitted samples of the oils and prepared wood block it intended to use, but after they were presented to the city chemist these were turned down and the samples submitted by Henkel were accepted on the ground that the samples of the plaintiff did not contain the largest possible amount of anthracene or anthracene oil. The plaintiff claimed that the plans and specifications did not call for any such conditions as were imposed after the bids were opened, and that in other respects the samples were as good as any of the others.

The defendants admitted that the samples came up to the specifications, but that it was concluded by the officials that the presence of anthracene made the Henkel Bros. bid enough better to warrant the city officials give the bid to them even if it cost more.

Judge Hollister decided that under the circumstances he could not grant the application, but that he might have done so had the matter been brought by a taxpayer.

Texas Drainage Law Constitutional.

In refusing a temporary injunction recently in the case of J. C. Parker et al. against Harris County Drainage District No. 2, Judge Charles E. Ashe of the Eleventh district court, at Houston, Texas, passed upon the constitutionality of the

drainage law, holding that it is free from defect.

When the case was originally filed, a temporary restraining order was granted by Judge Ashe, stopping the drainage work until a hearing could be had to determine whether the injunction sought by the plaintiffs should be granted. The hearing was had on documentary evidence and affidavits, and after hearing arguments and examining the law, Judge Ashe decided that the temporary injunction should not issue. The plaintiffs will carry the case to the court of civil appeals.

The plaintiffs complained, in their petition, that the drainage district was invalid, because, of the thirty-one parties signing the petition as freehold citizens of the territory, more than one-third thereof were not and never have been such resident citizens; that there was no legal notice of the filing of the petition, because of the four notices required two were posted at Erin, and two at Almeda, and none at other points in the district, contending that two notices posted at two different public places in the same town or village was not a compliance with the law, to post at four different public places in the district: that upon the hearing of the initial petition the boundaries defined therein were adopted and that the civil engineer who was ordered to locate the necessary drains and ditches extended the east boundary line of the district without authority from the court to do so, and that the court set down the report for hearing, without indicating there had been any change in the boundary lines of the district differing from those mentioned in the petition and without requiring in its order that a copy of the report should be published, to give parties affected information that their property was to be included in the territory of the district, and that the notice on the report of the engineer did not contain contents of the same, and that it was posted at two different places in the territory, instead of four, as in the case of the notices on the petition; that the notices of the election to establish the district and auhorize the issuance of bonds were only posted at two public places, instead of four public places; that the commissioners court declared the district established by metes and bounds as contained in the engineer's report, thereby enlarging the district as originally petitioned for and adopted by the court, without notice to property owners in the new territory to be affected thereby.

The plaintiffs asked for relief as follows: Enjoining a further levy of tax in the district; enjoining delivering of bonds or any part thereof to parties claiming or asserting any right thereto; that the drainage district and its commissioners be enjoined from entering upon or allowing other parties to enter upon any land in the district, to do or undertake to do any work thereon, or incur any expense or debt on or concerning the construction of drains, canals and ditches.

Judge Ashe held:

1. That the statute under which the drainage district was organized is free from constitutional defect and valid, and that under said statute there was a bona fide effort made to organize the district in question, and that the commissioners court by decree entered of record ordered it to be established with its present boundaries, finding in its several orders that the district was established upon the petition of the required number of freeholders of the district, and that due notices had been given at each step as required by law; that drainage commissioners were duly appointed and qualified and the district organized about one year ago; that the district on May 1, 1909, issued bonds in the sum of $200,000, which were approved by the attorney general of Texas July 21, 1909; that $165,000 of said bonds were sold to Kinnaer Bros. to be delivered from time to time, and that $35,000 of said bonds have been delivered and that the district has received the money therefor; that the district on or about the 23d of June, 1909, entered into a contract with Kinnaer Bros. for $150,-531 to operate and construct canals, ditches, etc., and that said Kinnaer Bros. at the time of the institution of the suit had for some time been engaged in the construction thereof, and had actually caused to be constructed under their contract a number of miles of canals and ditches, and had also done a considerable amount of cleaning, widening and deepening of the natural streams of the district at a cost of $22,000; that the district, through its officers, since the date of its organization in February, 1909, has been actively engaged in carrying out the purposes of its organization; these facts I understand to be uncontroverted from the evidence before me, and I conclude therefrom that as a matter of law the drainage district, as organized, constitutes, if not a de jure, at least a de facto public corporation whose legal existence can only be questioned in a direct attack by quo warranto.

The commissioners court having found, by its judgment, adopting the petition, that the requisite number of freehold citizens of the district had signed the same, I conclude as a matter of law that its judgment in this respect is final and can not be attacked in a collateral proceeding such as the present one, even admitting that the requisite number of resident freeholder within the district did not sign same.

I conclude that the notices on the petition were duly posted according to law, but admitting that they were not so posted, that the order of the commissioners court finding that proper notice had been given of the filing of the petition would conclude plaintiffs in this collateral proceeding.

The uncontroverted evidence in the case showing that the property of the plaintiffs, J. C. Parker, W. H. Parker and Morgan Davidson to be located west of the Gulf, Colorado and Santa Fe railroad, and therefore necessarily in the district as originally petitioned for, they have no cause of complaint under their pleadings in this case.

I find that the original petition for the district by reasonable intendment would include the land of the plaintiff, S. E. Allen, and that the notices given upon said petition were sufficient to put the said Allen upon notice that his property might

be affected by the organization of the district, and the said Allen having failed to appear before the commissioners court to protest against the formation of the district, can not now be heard to complain that he did not have his day in court, or that his property is being taken without due process of the law of the land.

Gainesville, Tex., Must Sue Water Company for Damages, Not Forfeiture of Franchise.

The supreme court of Texas reversed the judgments of the district court and court of civil appeals recently, and remanded the case of the Gainesville Water Company, a plaintiff in error, appealed from Cook County, second district. The City of Gainesville had sought to have forfeited the franchise of the water company for alleged inadequate service.

In reversing the judgments, the court says:

We realize that this is an important matter to the city. Fire protection is of great importance to its people from different standpoints. No less important is wholesome water for domestic purposes, and if it were made to appear in this case that the water company has wilfully and persistently refused to perform its contract with the city in those particulars, or that it was rendered unable by reason of its financial embarrassment to do so, then it would be the duty of the court to declare a forfeiture of the franchise. The evidence in this case would sustain a judgment for damages for violation of the contract if damages were sought and proved, but it is insufficient, as a matter of law, to authorize a court to forfeit the franchise of the water company.

Omaha Must Purchase the Water Works.

The United States supreme court rendered a decision, May 31, at Washington, under which the city of Omaha, Nebraska, will have to take over the Omaha water company's plant at an appraised value of $6,263,25. The opinion was written by Associate Justice Lurton, who said that the court of last resort found no error in the decree of the circuit court of appeals, and the case would therefore be remanded to the circuit court to be proceeded with accordingly.

After reviewing the bill in which the Omaha Water Company seeks specific performance by the city of Omaha of the contract for the purchase and sale of the sytem of works owned by the appellee company and reciting the manner in which the amount of money was to be paid by the city was determined, Justice Lurton said:

Three major objections have been urged against appraisement. First, that it is not concurred in by all the appraisers; second, that the appraisers heard certain evidence without notice or giving the city an opportunity to hear or rebut; and third, that the property valued includes a distributing system beyond the corporate limits of Omaha by which cetain suburban villages are supplied.

The matter in question was in no proper sense an arbitration. The contract was in all of its terms agreed upon. One party was to sell and the other to buy at the valuation determined by the board of appraisers, and "unanimously" was not stipulated, for unanimity was hardly to be expected in a board made up as this was. When a matter of purely private concern is submitted to a determination of other arbitrators the rule seems to be that there must be unanimity in conclusion by such board unless otherwise indicated by terms of submission.

The justice then cited certain cases bearing out this contention. He continued:

The rule is, however, otherwise when the submission is one which concerns the public. In such submissions, whether it be an arbitration of differences or an ascertainment of value, the majority may act unless otherwise indicated by agreement for submission.

The justice frankly admitted that he could not see just exactly why this distinction exists, but said:

The reason probably lies in the fact that public affairs are controlled by majorities, and by analogy a majority should control when submission is a matter which concerns the public. But whatever the reason, so are the authorities.

The court said it was satisfied with the conclusion of the circuit court of appeals that the acquisition of the system as it existed at the time the city made its election to purchase was within the contemplation of both the city and water company and that the valuation of the system as an entirety was a matter in which the appraisers were required to act. The most weighty fact in this connection is that the system was one single system, having a common source of supply and common main connection therewith. He said:

Its dismemberment is not to be thought of unless it is clear that the ordinance exercising the option is so plainly limited to the purchase of only so much of the distributing system as lay whlly within the corporate limits as to admit of no other meaning. A presumption against dismemberment is not overthrown even if the city had no power to sell the water to people or municipalities beyond its limits. If these outside distributing pipes could not be lawfully used by the city for the purpose for which the water company had used them, it does not follow that the contract to buy would be thereby any less a contract to buy the plant as a unitary system.

Justice Lurton further said the value in equity and justice must include whatever is contributed by fact of the connection of items making a complete and operating plant. The difference between a dead plant and a live one is real value and is independent of any franchise to go on or any more good will as between such plant and its customers.

In conclusion Justice Lurton said the circuit court of appeals had considered and decided all the large questions involved under the bill, but did not direct the precise form of the decree which the circuit court should enter and remanded the case with direction to reverse the decree, dismissing the bill and to proceed in ac-

cordance with the opinion. He then recited the opinion of the court below in which it was suggested that "If there should be found substantial defects in the property the opportunity should be given the company to remedy them, and, if it is unable to do so, parts of the property so circumstanced can be valued and the purchase price abated accordingly."

Collection of Asheville, N. C., Paving Assessments Enjoined.

Judge Justice, after hearing arguments from both sides, June 7, in the case of Schank & Johnson vs. the City of Asheville, N. C., and C. H. Bartlett, tax collector, continued the order restraining the city from collecting the paving assessments from residents of Southside avenue. The injunction will remain in force until the trial of the case at a regular term of the superior court. The city will make an appeal, in the meantime, to the supreme court to have the order set aside.

The Southside paving case grew out of charges made by citizens of Southside avenue that certain irregularities existed in the collection of the paving assessments for work done on the street in 1906. Many residents have paid all, and all have paid a portion of the assessments made against them by the city.

A Kansas County Can Assess Property for Dike.

A decision was handed down by Judge Dana, of the district court, April 30, at Topeka, Kan., holding that county commissioners of Shawnee county were right in their attempts to assess the property adjacent to the proposed dike on the south side of the Kaw river. The state attempted to enjoin the commissioners from making this assessment. Judge Dana says the action of the county commissioners would be regular and justifiable by law.

New Jersey County Can Build Drain for Street Improvement.

A decision was rendered May 5 in the proceedings instituted by the mayor of Paterson, N. J., to enjoin the Passaic county board of freeholders from carrying out their plans for the improvement of Main street in Paterson and Harrison street in Passaic. It was decided necessary to construct a drain in the road to carry off the surface water which might accumulate in a certain section of the road. The counsel for Paterson conceded that the drain was needed, but denied that it was within the power of the freeholders to order it built. Counsel also contended that Paterson, being the largest factor in the contribution of taxes by the county, was likely to pay a greater proportion of the cost of construction and therefore has a greater right to complain than any other section.

Judge Minturn, of the Supreme Court, declared that the advent of the automobile has given an impetus to road building upon a concerted and systematic plan throughout the country, and that it has resulted in a departure from the heretofore settled policy of this state as regards road building, and dismissed the proceedings.

Under the present policy of road improvement, he said it must be assumed that the freeholders had power to authorize such incidental improvements as might be needed to put the road in permanent good order.

Regarding the contention about the proportion of taxes, he said:

In the aggregate the contribution of taxes from Paterson is greater than that from the city of Passaic, but as a corporate entity its contribution presumably as an arm of the state government is little or nothing. What its individual taxpayers may contribute is another question, but they are not complaining, and upon a proceeding of this nature it is not clear how Paterson as a corporate entity can intervene to represent them.

Wisconsin Railroads Must Keep Up Viaduct Roadways.

The Wisconsin Supreme Court handed down a decision early in May, holding that the laws of the state give the city full power to compel railroads to keep in condition the roadways on viaducts where city streets cross railroad tracks. As construed by the court, the law not only requires the roads to do the paving, but gives the city the means of compelling them by doing the work itself, and then collecting the cost of it through the courts.

Macadamizing a Gravel Street Is Repaving.

In a decision handed down by Judge Albert Kunkle, at Springfield, Ohio, recently, he held that the macadamizing of a street that has been graded and graveled before, constitutes a repaving, and only one-half the cost can be assessed against the property owners.

Prizes for Making the City Beautiful.

The Board of Trade of Knoxville, Tenn., has offered a cash prize of $50 to the ward in that city that makes the greatest improvement in appearance between June 1 and September 1. The tender of the prize was made by David C. Chapman, president of the Board of Trade, to Mrs. L. D. Tyson, president of the City Beautiful League. The prize is to be awarded and paid on City Beautiful day, during the Appalachian exposition.

Concrete Fence Posts.

Farmers' Bulletin No. 403 of the U. S. Department of Agriculture is on the construction of concrete fence posts and was prepared by the Office of Public Roads. It gives full details of the process and principles with many drawings of pieces of apparatus and structures.

LIGHT AND WATER

Indianapolis Ornamental Lighting—Combination of Lighting Companies—Bay City Lighting Plant—Gas Companies of Washington—Pipe Durability—New Jersey Water Supplies—Galveston Immigrant Station—Ohio Valley Water Supplies.

Water and Light for Galveston's Immigrant Station.

An item has been incorporated in the sundry civil appropriation bill by Representative Burleson, of Texas, providing for the construction of an 8-inch cast-iron water main from Galveston across the channel of the harbor of Galveston to such place on Pelican Spit, Galveston harbor, as may be necessary to furnish ample water facility to the immigrant station thereon, $15,158; for the construction and complete installation of electric light, power and telephone cables between Galveston and the immigrant station on Pelican Spit, $5,000. In all $20,158 is appropriated.

Lighting of Business Streets in Indianapolis.

For many years the city of Indianapolis, very progressive in many ways, had the reputation of being very poorly lighted, and there was much justice in the complaint. A recent mayor attempted to improve this condition, first by an arrangement with the electric light company having the contract for lighting the streets. He was not able to bring the city council and the company to an agreement upon the cost of the additional light desired, the council not seeing its way to make an appropriation sufficient to meet the lowest price obtainable from the company.

Then came an offer from an advertising firm to install a large number of extra lights upon the principal retail business streets without cost to the city, provided it was allowed to place some rather inconspicuous advertisements upon illuminated glass plates contained in the fixture. One of these posts was put up on a prominent corner, and met with so much criticism that the offer was not accepted.

It happens that the Merchants Heat and Light Company was organized a few years ago by a number of prominent merchants to furnish steam heat and electric light for their own stores. There was so much demand for their service, before it was installed, that the plant was made large enough to supply a considerable part of the business district. This company was so successful that last year it installed a new plant in addition to the old one, the new one being the largest heat, light and power plant in the city.

In casting about for business for the new plant, the mayor's plan for extra lights on the business streets was taken up, and on the expiration of his term of office he was put in charge of the development of new business for the company. It being impossible to do the extra lighting at public expense, the proposition was made to the merchants that they install the lights at their own expense. The beginning under this plan was made largely through the aid of the merchants owning the lighting plant, who placed them in front of their own stores. This soon demonstrated the beauty and the value of the added light and resulted in many inquiries for the lights, and it was easy to extend the contracts for light, especially since the company supplies everything and charges for the light a definite sum per year per linear foot of the frontage of the property illuminated. The following blank form of contract shows all the details of the service furnished:

CONTRACT FOR ORNAMENTAL STREET LIGHTING.

AGREEMENT, Entered into this....day of.....19...., between the MERCHANTS' HEAT & LIGHT COMPANY, hereinafter called the Company, and..... .....hereinafter called the Consumer, both of Indianapolis, Marion County, State of Indiana.

The Company agrees to install and operate a system of ornamental street lighting to consist of ornamental Pressed Steel poles, each equipped with five one-hundred-watt tungsten lamps, poles to be placed at equal intervals of eighty-four feet on both sides of the street. The Company further agrees to maintain said poles during the life of this contract.

The Consumer agrees to pay for such service $1.05 per foot front or a total of ..... (....) per year as .....proportionate share, based on a frontage of.....feet. Payment to be made to the Company on or before five days from date of bill rendered. The bills shall be rendered in twelve equal monthly installments.

The hours of service of said ornamental street lighting shall be from dusk to 12:00 p.m. during the life of this contract.

In event the Company shall not secure sufficient similar contracts to cover the square in which the Consumer's property is located to warrant the establishment of the system of lights herein provided for within six months from the date hereof, the Company may at its option cancel this agreement.

This contract shall be for a term of

five years, beginning ....., 19...., and ending ....., 19....

This contract, although signed by an agent of the Company, is subject to the approval of the general manager, and shall not be binding on the Company until indorsed with his approval.

It is finally agreed that all the terms and stipulations heretofore made or agreed to by the parties in relation to said street lighting service are merged in this contract, and that no previous or contemporaneous representations or agreements made by the Company's officers or agents, shall be binding upon the Company, except as and to the extent herein contained.

.....

MERCHANTS' HEAT & LIGHT COMPANY.

By .....

Agent.

.....

Consumer.

By .....

Approved....., 19..

.....

General Manager,

MERCHANTS' HEAT & LIGHT COMPANY.

These contracts are made by the tenants on the street floors of the buildings.

The standards used are made of pressed steel, two plain tapered truncated cones of 22 gauge high-carbon non-oxidizing steel being forced together, one inside the other, and then fluted like Doric or Corinthian columns. This column is fitted with a decorative base and a top carrying four suspended 100-watt tungsten lamps on four arms and one lamp on top of the post, all inclosed in diffusing globes. The top globe is 16 inches in diameter, the lower globes are 12 inches. The lamps burn from dusk to midnight every night. As shown in the contract the standards are set 84 feet apart along the curb line and the charge for the entire service, under a 5-year contract is $1.05 per year per front foot. The standards are wired from a 3-wire lead-covered cable run through a 4-inch tile set one foot from the curb and one foot under the surface of the gutter.

The Indianapolis Light, Heat and Power Company, operating a plant covering the entire city and having the street lighting contract had obtained permission to install a number of arc lights on tall overhanging standards of good design around the monument circle, on which the company's office is located, and put these standards in place about the same time. When the success of the younger company in extending its lighting system was observed, the older company took a hand also, and soon both companies were claiming the rights for the same block of street and were actually constructing two systems on the same block. This conflict was soon settled by the Board of Public Works and now permits are issued for each block of street to the company showing contracts for a majority of the frontage. The Indianapolis company now uses a cast-iron five-light tungsten lamp standard of similar appearance to those used by the Merchants' company, but somewhat lighter and more graceful. The passer-by scarcely notices the difference.

Because of the handsome appearance of the lights and the thorough distribution of the illumination over the street, the extension of the systems over the retail districts has been rapid, and over two miles of street are now lighted, practically all of them on both sides of the street. Washington street alone has nearly a solid mile of the lights in operation, and Illinois, Meridian and Pennsylvania streets are extending the lights each way from Washington street, with occasional blocks on other streets. Massachusetts avenue is another broad street having a half mile or so of lights on both sides of the street.

The only complaint that has been heard is from a member of the Art Association and the Civic Improvement Commisson, who thinks the display of glassware is too lavish, but the pleasant diffusion of the light, and the absence of glare and shadows certainly offset at night the comparatively slight effect of overweighted street during the day.

Consolidation of Lighting Companies.

The American Gas and Electric Company, of New York city, which owns the electric light plant in Hartford City, Ind., has purchased the Dunkirk Lighting Company. The company has been granted a franchise for a lighting plant at Redkey, and owns the electric light plants at Marion and Muncie.

Bay City's Lighting Plant Will Purchase Current.

Bay City, Mich., will, within 12 months, abandon the manufacture of electric current in its two municipal plants, and will take current from the Tittabawassee Power Company. Council voted, June 13, to make a contract with the company, to furnish this city with current at 8 mills per kilowatt hour. The city plants are now making electricity at slightly over 2 cents per kilowatt, and by an expenditure of $60,000 for modern machinery and combining plants should reduce the cost to 1½ cent per kilowatt. The city will guarantee to take a minimum of 50 kilowatts per hour and may run up to 1,600, and the Tittabawassee company will guarantee the delivery of current, July 1, 1911. The city will not abandon the commercial field established by the municipal plants, but will extend its system and furnish current at about one-third the present prices to private concerns.

Bill to Control Gas Companies in the District of Columbia.

A comprehensive bill was favorably reported by the House committee on the District of Columbia, June 14, to fix the price of gas in the District at 85 cents

a thousand cubic feet; to prohibit the local gas light companies from watering their stock; to provide for meters that may be plainly read by customers, and making other changes in the local law with respect to the manufacture and sale of gas. The bill is a substitute proposed by Representative Condrey, of Missouri, for the various pending bills affecting the production and sale of gas in the District. The measure provides that after the passage of the bill the Washington Gas Light Company and the Georgetown Gas Light Company may continue to charge 90 cents a thousand cubic feet until August 31, 1910, when the 85-cent rate shall go into effect. This section also specifies that hereafter "the standard rate of dividend to be paid by said companies to their stockholders, not to be increased otherwise than as hereinafter provided, shall be 6 per cent per annum upon the par value of their capital stock, which capital stock may be increased as herein authorized by said companies to amounts equal to the actual net value of the physical property of said companies, including working capital, as shown by the present book value of the same, less their outstanding funded liabilities respectively."

A limitation upon this authorization provides "that the total amount of capital stock hereby authorized shall not exceed in either case a sum equal to an amount found by capitalizing the amount of taxes paid by said companies for 1909 upon the taxation basis established by the acts of June 1902."

In any event, it is further provided, the total amount of the capital stock of the Washington Gas Light Company shall not exceed $6,500,000, and the total capitalization of the Georgetown Gas Light Company shall not exceed $300,000, without the express consent of Congress.

The Washington Gas Light Company, according to the bill, "may refund its outstanding liabilities to an amount not exceeding $3,200,000 into 5 per cent bonds, payable when the board of directors may determine, and that hereafter it shall be unlawful for the companies, or either of them, ever to issue any additional bond certificates of indebtedness or any other evidences of debt except such as shall actually be required for the payment of necessary betterment, extension or improvement without the express consent of Congress."

All evidences of indebtedness issued in violation of this inhibition are declared to be void by section 2 of the bill, and the gas company offending is made liable to a penalty of $1,000.

Section 3 provides that "during any year after the passage of this act wherein the maximum net price per thousand cubic feet charged by the said companies has been less than the standard price, the companies may pay dividends exceeding the standard rate, in the ratio of one-fifth of one per cent for every one cent of reduction of said maximum net price below the standard price.

Section 4 of the measure direct the gas companies to publish every September, in one or more local newspapers, a report for the previous fiscal year, showing among other things, "the cost per thousand cubic feet to such companies of gas in the holder, itemizing said cost so as to show the cost per thousand feet for gas manufactured, of wages at works and of the main items of materials; also the cost per thousand feet for distribution; also the amount per thousand feet, if any, charged for maintenance and repairs."

In case the clear profits of the companies applicable to the payment of dividends amount in any years to a larger sum than is sufficient to pay the dividends which the companies are authorized to pay by this bill, "the excess above the sum necessary for that purpose," the bill provides, "may from time to time, to the extent of 1 per cent per annum of the par value of the stock of the companies, be invested in government securities, and the interest arising from such securities shall be also invested in the same securities in order that the same accumulate at compound interest until the fund so formed amounts to a sum equal to one-twentieth of the par value of capital stock of the companies, which fund shall form a reserve fund; provided, that when and so often as the said fund shall, by reason of the accumulation of interest or dividend or otherwise, exceed one-twentieth of the par value of the capital stock the excess shall be carried to the credit of the clear profits of said companies applicable to the payment of dividends."

By the terms of the bill the companies are permitted to use this fund or any portion of it to meet any extraordinary claims, demand, or charge that may arise at any time from fire, accident, or other unavoidable circumstance.

It is also provided that the companies may use this fund toward the payment of dividends in case its profits are not sufficient to do this.

In case either of the companies shall make more in one year than it is authorized to pay in dividends plus the amount directed to be set aside in the reserve, and this excess is sufficient to increase the annual rate of dividends by 1 per cent, then the bill directs such company to reduce the price of gas the following year 5 cents per thousand cubic feet.

Section 7 has to do with meters, and directs that "no meter shall be used which may confuse or deceive the consumer in ascertaining the price he pays per thousand cubic feet or the number of cubic feet consumed."

Section 10 prohibits the gas light companies from refusing to supply gas for

any building or premises to any person applying therefor because a bill for gas remains unpaid by a previous occupant of the building.

Section 12 provides that inspectors or readers of meters shall be appointed by the justices of the supreme court of the District, and must subscribe to an oath to make and take true readings only.

Durability of Cast Iron Pipe.

While making repairs to the water works system of Eugene, Ore., recently, a section of pipe laid twenty-four years ago and in constant use ever since, was taken up in apparently as good condition as when first laid. The pipe, which had been covered with a preparation of tar, would have still served its purpose for years, but for the fact that it is too small.

Proposed Water Supply for Several New Jersey Cities.

At a conference held June 12 by representatives of Montclair, Paterson and Passaic, N. J., and Morris R. Sherrerd, of the State Water Supply Commission, the interests of those municipalities in the acquisition of a water supply were discussed. The proposition of the Water Supply Commission provides for the construction of a system of reservoirs, under authority of the State, the cost to be levied on the municipalities benefited. It is proposed to meet the cost of maintenance by a pro rata assessment of the municipalities using the water thus provided, on the basis of their respective consumption. It is the purpose of the Water Supply Commission to construct these reservoirs in the Wanaque valley, the acquirement of which for a water shed has been Paterson's ambition. Paterson has suggested an alternative proposition, of joining with Passaic, Montclair and other municipalities in acquiring water rights, but the respective merits of the two schemes are still to be determined.

Surface Water Supply of Ohio River Basin.

The Geological Survey is publishing in its Water-Supply Papers numbered 241 to 252 a series of reports showing the flow of streams in the United States as determined by measurements made in 1907 and 1908. Papers 241, 242, 244 and 252, covering respectively the streams of the north Atlantic coast, the streams of the south Atlantic and eastern Gulf coasts, the streams of the St. Lawrence basin, and the streams of the north Pacific coast, have already been published. Water-Supply Paper 243, relating to the streams of the Ohio river basin, is now ready for distribution.

The information collected in these reports is essential to navigation, irrigation, water power, domestic water supply, drainage, and flood prevention.

A special feature of Water-Supply Paper 243 is a table giving a summary of mean monthly discharge in second-feet per square mile for streams in the Ohio river basin for 1907 and 1908. This table affords a means of making comparisons of relative rates of run-off for different areas in the basin. These comparisons show, in a general way, the seasonal distribution of run-off and the effect of snow, ground, surface, and artificial storage. The almost entire lack of uniformity or agreement between any two stations indicates that the discharge of each stream is a law unto itself and that the safe and economical development of any project that is dependent on stream flow must be based on long records collected with great care as near the location of the project under consideration as possible.

Public Comfort Station for Indianapolis.

Indianapolis is about to open its first public comfort station, which has been well located in close proximity to the busiest corner in the city, at least so far as visitors from outside the city are concerned. At the intersection of Washington street, 120 feet wide, and Illinois street, 80 feet wide, a diagonal street, Kentucky avenue, 90 feet wide, runs off to the southwest, in a direction which business has thus far shunned, perhaps because no car line has run on this street until recently, and none now runs over the first block of the street.

The public comfort station is located in the center of Kentucky avenue, where it touches the area formed by the intersections of the three streets named, and is mainly below the surface, the roof extending about 3½ feet above the level of the street. Above this roof is an ornamental ventilating shaft, finished as oxidized copper, with the inscription, "Public Comfort Station," quite similar in appearance to other stations of the same sort. It has rounded ends, with entrance and exit by separate stairways. The entrance for men is nearest the corner and that for women at the opposite, southwestern end. The station is about 75 feet long by nearly 25 feet wide, with a wide asphalt driveway on each side. The interior is divided into the two sections for men and women, with urinals, closets and washbasins, in what has become the standard design for such structures, and will certainly prove to be a great convenience, particularly to strangers in the city.

The only question which the observer asks is why it is placed so far below the surface, since it completely occupies the surface area and would be even more accessible if it were not down so many steps.

The example is a good one for Indianapolis itself to follow, as well as other cities.

STREETS AND SEWERS

Repaving vs. Repairs—Sand-Clay Roads—To Utilize Sewage—Los Angeles Garbage—Refuse Dump in Lake Michigan—Chicago Sanitary District Power Plant.

Repaving Versus Repairs.

Mayor Reyburn and Director Stearns, of Philadelphia, Pa., are considerably concerned regarding bills that have been introduced in councils providing for wood block paving in Arch street. One bill has passed select council, directing that the repaving shall be taken out of the fund of $600,000 paid into the city treasury by the Philadelphia Rapid Transit Company for "repairs" to streets upon which there are street car tracks. This bill provides for repaving from Seventh to Twenty-second streets, while another bill introduced provides for repaving from Seventh street to the Delaware river. The only money available is the traction paving fund, and both Mayor Reyburn and Director Stearns are convinced of the illegality of paying for repaving out of funds for repairs. A survey will probably be made of the entire city with reference to needed repairs, with the result that the number of square feet of each kind of repaving and repairs needed will be tabulated.

Sand-Clay and Earth Roads.

The U. S. Department of Agriculture, Office of Public Roads, includes in its Circular No. 91 a report by W. L. Spoon, C. E., superintendent of road construction, on "Sand-Clay and Earth Roads in the Middle West," which gives the results of experiments conducted in Kansas and the surrounding country in 1908, under the plans of the office.

Los Angeles Has a Garbage Nuisance.

In a recent number of the *Pacific Outlook*, published at Los Angeles, Cal., appears the following:

Part of the trouble over the Charles Alexander garbage contract arises out of the nuisance created by the unloading of the carts into the cars that convey the stuff out of the city; and 90 per cent. of this nuisance is unnecessary and could be corrected at a little cost and some care. To the disinterested spectator, it would seem as though the contractor and the railroad were both desirious of making things as bad as can be instead of as good as might be. The location is near Aliso street at the mouth of the Arroyo, where the Pacific Electric cars enter on their private right of way. There is a short piece of street or road leading to the place of unloading—say 150 to 250 feet long. As the wagons pass and repass over it great clouds of dust go up—filthy dust full of germs. Why is it not oiled or at least wet down? The P. E. could gravel it at small expense as it is right along the track. Then there is 100 feet of track where the loading takes place, more or less filthy all the time from fragments of garbage that fall from wagons and cars in the process. These are ground into the soil. At small expense—relatively—all this area could be made solid with packed oil gravel, or for that matter it could be filled with asphalt concrete, so it could be scrubbed clean once a day. This would do away with a large part of the smell that annoys the neighboring people and those who pass there in the P. E. cars. Then the process of unloading deserves a prize for stupidity. The wagon beds are lifted with a derrick and dumped into the cars. Only they do not dump. They hang at an angle instead of perpendicular, which makes it necessary to have men standing in the garbage to claw the stuff out with rakes—a slow, filthy performance that prolongs the smells and increases them. It would be a very simple matter to equip the beds so that they could be hung up on end and dump their contents instantly. Some of the wagons have canvas covers, but none of them seem to be large enough to completely shut in the contents—as the San Francisco wagons are arranged—and some of them have covers made of burlap, which is useless. The cars also should have canvas covers which should be drawn along and fastened in place as the filling proceeds, and there should be a sufficiency of these covers so they can be kept fairly clean. Both the cars and the wagons should be water-tight. With some such changes as these the place could be used for the loading of garbage without disturbing anybody in that vicinity, but as it is now it should be condemned by the Board of Health.

An outsider may perhaps be allowed to make a long-distance suggestion that there are in the market garbage wagon and cart bodies with tight covers which, by the installation of a light derrick could be lifted from the wagon or cart gears, piled up on flat cars, hauled to the garbage disposal plant and there emptied so that there will be no such nuisance as that described above anywhere except where it can be properly regulated. The wagon bodies can then be washed with hose or other convenient method and be returned to the loading place and replaced on the gears. Two or three times as many wagon bodies as gears might be required, so that the exchange can be made of empty for full body and no time be lost by the team.

Wish to Utilize Denver Sewage.

The Denver Irrigation and Fertilizer Company, incorporated in March by Richard L. Fuller, Charles J. Johnson, S. Roy Wright, Richard S. Fuller, Jr., and Theo-

dore Thomas, all of Denver, has in contemplation a plan for utilizing the sewage products of Denver, provided the city will sell the company a perpetual right to the use of the waste water and sewage from the city's sewerage system. The company proposes to build a system of conduits to receive the waste water and sewer discharge, convey it to a large plant north of the city in Adams county, cleanse the water by filteration, for irrigation, and manufacture fertilizer from the refuse, and dispose of that for profit.

Refuse Can Be Dumped in Lake Michigan Only Behind Breakwaters.

A final agreement has been reached by the senate and house conferences at Washington, on the Mann bill, which prohibits dumping within eight miles of the shore line of Lake Michigan, except behind breakwaters for the purpose of making land.

The great benefit derived from the law will be in the health features, but the permission to make land with the thousands of tons of refuse thrown away annually will be of great value to the city. A steady improvement of the water supply and the requirement of more parks along the lake front are counted among the other boons to be desired.

Chicago Sanitary District Makes Money in Power Plant.

In a report of the electrical department of the Chicago Sanitary District, submitted to President R. R. McCormick, it was shown that there is profit in the Chicago Sanitary District's sale of power and light current. After every deduction, including interest on the invested capital, a balance of $63,211.46 is shown. For sales of current there was received $385,564, while other items brought the gross income of $391,936. Out of this came $183,452 for operation and other expenses for the year, which includes an allowance of $46,216 for depreciation. Interest on plant and equipment was specified as $145,273.

Every month in the year, except April, showed a profit in the electrical department, and after the first four months there was a steady increase in net earnings and profits above fixed charges.

Chicago was the best patron of the Sanitary District among the dozen public institutions listed as buyers of electricity. The city paid $143,184 and the west parks came next with $15,823. Morgan Park paid $4,040, smaller sums being received from Lockport, Berwyn, North Berwyn, Cicero, Lyons, and Blue Island. Lincoln Park paid $6,240, the Isolation hospital $583, and the Cook county hospital $403.

These public institutions used 67 per cent of the current generated by the canal's flow from Lake Michigan. Of this Chicago bought 56 per cent for street lighting.

Expenditures on the plant and equipment in the year were $696,309, which brought the total outlay under that head up to $4,036,599.

Consumers of the district's current in 1909 numbered 811, of which municipalities were thirteen. Concerns buying electricity for commercial light numbered 695, mostly in Blue Island, Berwyn, and Lockport, while the purchasers of commercial power were 103. The department's employes numbered 265, of whom 99 were used in maintaining overhead lines.

Census Reports of Cities on Street Cleaning, Lighting and Water.

The Census Bureau's special annual report for 1907 on the statistics of 158 cities having a population of over 30,000 each, contains many comparisons. The section devoted to the subject of street lighting includes payments for expenses of street lighting per acre of land area and per capita; lights classified by kind, number, candle power, price for light per year; number of hours lighted per year; average number of each kind of lights to each 100 miles of streets. The report says:

The cities with the highest per capita payments for lights were Yonkers ($1.59), and Los Angeles ($1.37); and those with the largest payments per acre of land were Hoboken ($35.03), and Boston ($32). Owing to the great length of their unimproved streets, the average number of lights to 100 miles of streets is very small in some cities. Of the cities using Welsbach lights, largely in the residence districts, Boston leads in the number used in proportion to street mileage, followed by Washington, St. Louis, Cleveland, New York and Baltimore.

In comparison with similar statistics for 1905, it is interesting to note that the flat flame gas lamp is fast disappearing from use, the per cent. of decrease in number reported amounting to 43.7. This decrease has been offset by a large increase in the number of Welsbach, incandescent and arc lights.

Regarding street cleaning, it says:

Street cleaning cost New York city in 1907, $6,941,912, though a portion of the cost of refuse disposal is included in this amount. The city next in rank was Philadelphia, which paid less than a million dollars for maintaining its street-cleaning department.

Cities of over 300,000 population with a small expense for street cleaning were Milwaukee ($129,380), New Orleans ($138,993), and Buffalo ($189,683). The cities with the largest areas cleaned at least once a week were New York, 25,312,729 square yards; Philadelphia, 17,270,034 square yards, and Buffalo, 12,736,158 square yards. New Orleans had the smallest such area for cities of over 300,- population, or less than one million square yards.

Nearly all of the area in New York, Chicago and San Francisco subject to regular cleaning was swept by hand, while most of that in Pittsburg, Detroit, Boston, and large areas in Philadelphia, Buffalo and Washington were swept by machine.

In Buffalo, St. Louis, Cincinnati and

Detroit large areas were cleaned by flushing, though this method in Buffalo was only an experiment and was continued for only two weeks. In comparison with similar figures for 1905, the area regularly cleaned by flushing shows a large increase.

On water supply systems it says:

Of the 158 cities reported, 117 owned water-supply systems whose estimated value at the close of 1907 was $647,334,495. The revenue receipts from the public amounted to $52,831,096, and the actual expenses of operation to $21,281,273. The excess of receipts over operating expenses was, therefore, $31,599,823, nearly two-fifths of which was consumed in payment of interest on the outstanding debt. The remaining three-fifths were apparently net profits, but it is impossible to argue from this result that municipally owned water-supply systems are exceedingly profitable.

Cities owning their water works do not receive taxes from them, and in few cases charge off a sufficient amount for depreciation. The report states that the financial results indicate, when these factors are taken into consideration, that few systems are operated at great profit, while some are conducted at an actual loss. Some cities, however, aim to furnish water to their citizens at cost, and it is possible that in such cities water rates are lower than they would be if the water system was owned by private parties.

ORGANIZATIONS AND INDIVIDUALS

International Road Congress—National Irrigation Congress—Society for Testing Materials—Indiana Municipal League—Technical Meetings—Technical Schools—Civil Service—Terra Alta Mayor—Personal Notes.

The International Road Congress and Association.

The Permanent International Association of Road Congresses is organizing at Brussels the Second Congress on Roads, while the Universal Exhibition is in full swing. The meeting will take place on July 31 next at the "Palais de la Nation," at Brussels.

The Congress will be divided into three sections and the languages, the use of which is authorized for discussions in either section, are German, English and French. Papers and proceedings will be printed in the three languages and delivered to all members; they form two volumes, having 1765 pages, and containing engravings and 51 plates out of text.

The association includes members from all countries; it is under the control of a permanent commission and of a permanent council, consisting of members of each State, whose number is proportionate to the amount of the annual subscription granted by their government to this undertaking.

Every member of the permanent association is ex-officio member of the congress; the subscription for the membership in the association amounts to 25 francs for the year 1910 and to 10 francs for the following years.

Write for further information to M. Mahieu, Secretaire General, 1 Avenue d'Iena, Paris.

National Irrigation Congress.

The National Irrigation Congress, which gained such wide-spread recognition at the Spokane convention last summer, will have its eighteenth session at Pueblo, Colo., September 26 to 30, under the presidency of B. A. Fowler, of Phoenix, Ariz., who has been actively identified with the organization for years. It is promised there will be several thousand delegates, including practical agriculturists and irrigationists, from all parts of the United States, Canada, also from 30 to 40 foreign representatives and diplomatists, heads of national and state departments, capitalists and engineers.

There will also be an exposition of apparatus for raising and putting water on the land and representative exhibits of products of irrigated tracts, thus bringing together in the heart of the Arkansas valley the most comprehensive demonstration of the value of irrigation in the history of the movement. Colorado has a larger acreage under ditches than any of the western states, and, as practically every approved method of distributing water is in use in that state, there will be opportunities to study the various plans of supplying moisture by artificial means to the land.

In the states from the Missouri river to the Pacific ocean there are fully 3,000,000 acres under irrigation or to be watered in the near future. Allowing an

average of 20 acres to a family and five persons to a family, this acreage will support 750,000 persons. To this number might be added 570,000 more, representing the number of persons needed to supply the wants of these tillers of the soil and to transport their products.

American Society for Testing Materials.

The thirteenth annual meeting of the American Society for Testing Materials is held at Atlantic City, N. J., June 28, 29, 30, July 1 and 2. Reports from all the standing committees are presented, with a number of papers upon each subject. The papers include the following: "Some Recent Tests of Cast Iron," by A. E. Outerbridge, Jr.; "The Forest Products Laboratory, Its Purpose and Work," by McGarvey Cline; "Measured Strains in a Steam Boiler Under Hydrostatic Tests," by James E. Howard; "Tests on Steel and Wrought Iron Beams," by H. F. Moore; "Strength of Steel from I-Beams," by E. L. Hancock; "Aluminates: Their Properties and Possibilities in Cement Manufacture," by Henry S. Spackman; "The Effect of Sodium Silicate Mixed with or Applied to Concrete," by Albert Moyer; "Comparative Tests of Lime Mortar, Both in Tension and Compression; Hydrated Lime and Sand, Lump Lime and Sand, and Cement, Lime and Sand," by E. W. Lazell; "Tests on Reinforced Conrcete Columns Subjected to Repeated and Eccentric Loads," by O. M. Withey; "The Distribution of Stress in Reinforced Concrete Beams, Including a Comparative Study of Plain Concrete in Tension and Compression," by A. T. Goldbeck; "A Sand Specification and Its Specific Application," by W. A. Aiken; "A Method for Testing the Protective Power of Paints When Applied to Iron and Steel," by W. H. Walker and M. T. Jones, Jr.; "Another Solubility Test on Protective Coatings," by G. W. Thompson; "The Painting of Cement and Concrete Structures," by Charles MacNichol; "Classification of Fine Particles According to Size," by G. W. Thompson; "The 600,000-lb. Testing Machine of the University of Wisconsin," by H. F. Moore and M. O. Withey; "Apparatus for Repeated Loads on Concrete Cylinders and a Typical Result," by H. C. Berry; "The Determination of Soluble Bitumen," by Prevost Hubbard and C. S. Reeve; "Improved Instruments for the Physical Testing of Bituminous Materials," by Herbert Abraham; "Necessary Reforms in Specifications for Petroleum Products," by Albert Sommer; "A New Machine for Testing Pitch," by T. Y. Olsen; "Fuel Investigations, U. S. Geological Survey; Progress During the Year Ending June 30, 1910," by J. A. Holmes.

Officers for the ensuing term (1910-12) are as follows: President, Henry M. Howe; vice president, R. W. Lesley; secretary-treasurer, Edgar Marburg; member of the executive committee, James Christie.

Indiana Municipal League.

The convention of the Indiana Municipal League was held at Richmond, Ind., June 21, 22 and 23. A banquet was given by the Commercial Club, complimentary to the delegates. Responses were made to the toasts, as follows:

"Richmond," Mayor W. W. Zimmerman; "The Commercial Club's Relation to City Government," Lemuel Darrow, mayor of Laporte; "Some Shop Talk," Mayor Samuel Lewis Shank, of Indianapolis; "Municipal Honesty," James W. Fortune, city attorney, Jeffersonville; "Municipal Laws," Senator Will R. Wood, Lafayette; "Making Municipal Government an Asset," John McVickar, Des Moines, Ia.; "The Municipal League," Lawrence Becker, mayor of Hammond; "Civil Service Reform in Municipalities," William Dudley Foulke.

During the convention W. A. Dehority, examiner of public accounts, in an address relative to the work of his department, said:

The training of the majority of men elected to public office has been on an altogether different line from that which they are to assume. An officer observes the manner in which his predecessor has been conducting the affairs of the office, and usually proceeds on the same line. As a result, within the various counties, cities and towns, many methods of accounting have been in use; in fact, in many places the only financial record to be found are the bank pass books, some of them being in a very chaotic condition.

Because of improper methods of accounting, reporting and investigating, many officers were at the close of their terms compelled to sacrifice their property or call on their bondsmen to liquidate a shortage which did not really exist. The repressive effect of the public accounting law will reduce such to a minimum. In such a case the damage has been both monetary and moral, to the chagrin and detriment of the officer and his friends, all without intent on the part of the accused. In one county an officer was short more than $40,000. The officer was convicted for embezzlement and sent to prison, where he served one year. There was absolutely no evidence of the officer being benefited on account of misappropriation of the funds. The entire matter was charged to an extravagant clerk, who also served a term in prison.

An ex-township officer deposited in a bank the amount of $661.47, but had neglected to account for it on his records. This condition was not known, and the township was without the funds until discovered by field examiners representing the department of inspection and supervision of public accounts.

An investigation of the records of the township officers and one city office in twenty-three counties shows apparent shortages and misapplied funds in the amount of $120,092.94. Since the examination of these accounts a reimbursement was made of $22,309.47. The total cost of examinations was $16,855.92.

The object sought by the Municipal League and the results hoped for are no

doubt the honest, thorough practical, legal administration of municipal affairs. These results can be attained in a measure through the medium of the public accounting law, with the co-operation of the good people of Indiana in general and the Municipal League in particular. An honest administration of public affairs is demanded, and through the board of public accountants every public official is bound to give a strict account of his stewardship.

The law demands that public accounting shall be efficient and expeditious, that there be a complete statement to the taxpayers of each and every transaction. It demands that public accounts be kept in a practical manner to the end that the interested citizen may be able, upon inspection of the records, to fully understand them. It insists that in the conduct of public officials the laws be obeyed in spirit, and not conducting the affairs of public office along the lines of personal opinion, regardless of the statutes of Indiana and contrary thereto. When in the adoption of uniformity of system and practicability in administration, improvements are found necessary that will benefit the public at large, the same will be brought to the attention of the general assembly for incorporation into the accounting law of the state of Indiana, and the same can be more readily accomplished by the united and enthusiastic support of your organization.

Mayor Burke, of Jeffersonville, discussed "Public Improvements;" Dr. J. N. Hurty, secretary of the State Board of Health, talked on "Sewage Disposal;" A. M. Gardner, city attorney of Richmond, "Municipal Ownership and Franchises;" J. A. Gavitt, city attorney of Hammond, "Public Utility Commission;" H. C. Hogan, of Ft. Wayne, "Track Elevation."

Officers were elected as follows: President, Lemuel Darrow, mayor of Laporte; vice presidents, Jas. E. Burke, mayor of Jeffersonville, and John Thom, of Noblesville; treasurer, Loren Mellette, of Elwood; secretary, F. B. Robinson, city clerk of Crawfordsville.

The meeting next year will be held at Crawfordsville.

Technical Meetings.

The Montana Society of Civil Engineers was organized recently at a meeting held at Helena. Officers were elected as follows: President, Robert H. Lindsay, of Butte; vice president, Robert Liblery, of Missoula; secretary-treasurer, Arthur Ireland, of Helena. The first regular meeting of the society will be held the second Saturday in Jenuary, 1911.

The annual convention of the Ohio Electric Light Association will be held at Cedar Point, O., July 26, 27 and 28. D. L. Gaskill, secretary, Greenville, O.

The second annual convention of the Pennsylvania Engineers was held at Harrisburg, Pa., June 1, 2, 3 and 4, under the auspices of the Engineers' Society of Pennsylvania. One of the matters to receive much attention was the affiliation of all the engineering interests of the commonwealth by the adoption of a general form of constitution and by-laws and uniform standards of membership for the various local engineering organizations. A representative form of government is to be adopted in this proposed federation. The formulation of a professional code of ethics and the control of the practice of engineering in the state by legislation, received consideration, but no definite action was taken. Among the papers read at the meeting were the following: "The Improvement of the Highways of America," was to have been presented by Logan Waller Page, director of the Bureau of Highways, U. S. Department of Agriculture, but owing to his absence a paper was read by L. E. Bopkin, of the Bureau of Highways; "Road Work in Pennsylvania and Some of Its Problems," by Joseph W. Hunter, State Highways Commissioner of Pennsylvania; "The Melville Mac Alpine Reduction Gear," by J. A. MacMurchie; "Sanitation," by Dr. Samuel G. Dixon, State Commissioner of Health.

The Year Book for 1910 of the Merchants' Association of New York has been issued.

The Ohio Valley Exposition will be held in Cincinnati, August 29 to September 24.

The annual report of the Merchants' Association of San Francisco tells of the valuable work of this public spirited association during the year.

The proceedings of the third annual convention of the Indiana Sanitary and Water Supply Association have been issued by Frank C. Jordan, the secretary, who is also secretary of the Indianapolis Water Company. It is a well printed volume of 145 pages and contains a remarkable series of papers and discussions to have been presented in the three sessions of a single day.

The proceedings of the 22d annual meeting of the Iowa Engineering Society have been issued by secreary S. M. Woodward, Iowa City.

The Merchants' Association of New York has been arranged for reduced rates to New York at four dates in July, August and September in Trunk Line territory, with 15 days return limit and at four dates in July and August in Central Passenger Association territory with 30 days return limit, on terms explained in the association's circulars. There will also be summer session tourist fares from the western part of the territory named.

The forty-second annual convention of the American Society of Civil Engineers was held in Chicago on June 21-24, inclusive, at the Congress Hotel. Mr. John A. Bensel delivered the annual presidential address and a special committee reported on legislation affecting engineering practice. Mr. Alfred Noble gave an illustrated talk on the New York terminal of the Pennsylvania Railroad, and Mr. J. Waldo Smith one on the new water supply of

New York City. At the final meeting there was an illustrated lecture on the recent plans for the general artistic betterment of Chicago.

The remaining time of the convention was devoted to excursions to the municipal park system, the Gary steel plant, the regulating works and power plant of the drainage canal at Lockport, the new passenger terminal of the Chicago & Northwestern Railway, the central stations of the Commonwealth Edison Company, the mail order plant of the Sears-Roebuck Company, the new plant of the Western Electric Company, the army post at Fort Sheridan and the naval training station at Lake Bluff.

The New York Electrical Society held its annual meeting at the new station of the Pennsylvania Tunnel and Terminal Railroad Co. on June 15, and made a thorough inspection of the plant. Robert T. Lozier was elected president, Geo. H. Guy, secretary, and Henry A. Sinclair, treasurer.

President Baxter of the American Society of Engineering Contractors has appointed a committee on uniform specifications of which W. R. Harris, Louisville, Ky., is chairman. About thirty subcommittees of one or two members each have been appointed to aid in the work.

The Technical Schools.

The Baldwin Prize for the best essay on a municipal subject offered by the National Municipal League has been awarded to Oswald Ryan, an undergraduate student of Harvard University. Honorable mention was made of the essays of E. Clyde Robbins, of the State University of Iowa, and Roger F. Hooper of Harvard. Thirty-eight essays were submitted. The subject treated was "The Commission Form of Government."

The announcement of the graduate school of Cornell University for 1910-11 is contained in *The University Records* for April.

The University of Illinois Bulletin, Water Survey Series No. 7, contains the report of 1908 of Edward Bartow, director of the chemical and biological survey of the waters of Illinois.

City and town promotion is the subject of a course now offered by the Extension Division of the University of Wisconsin. The course points out that no business can outgrow its city or district, and that with the advance of the section in which it is located. The history of the work of business men's associations is dwelt on, and the discussion of their organization and methods forms the chief part of the course. The topics treated are: Promotion for the city, town, and village; becoming the center of a district; stimulating surrounding country; widening trade area; agricultural developments; markets and exchanges; rendering a city attractive; unconscious psychological effects; the publicity bureau; attracting residents; attracting manufactories; improving business conditions; business men's associations; organizing and conducting the work of promotion. Benjamin H. Rastall, Associate Professor of Business Administration has charge of the work in this course. Further information can be secured by addressing the University Extension Department, University of Wisconsin, Madison, Wis.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

July 13. Assistant Engineer in Reclamation Service at $1,500 and upward and Junior Engineer at $900 and upward.

July 20,21: United States Surveyor in the General Land Office at $100 a month, traveling and subsistence expenses when in the field.

July 27, 28: Topographic draftsman in Coast and Geodetic Survey at $900 to $1,500. Copyist draftsman at $900 to $1,500.

Mayor of Terra Alta Resigns.

Declaring that any man who could preside as mayor and indulge in intimate association with the members of the city council of that city without losing his temper and better judgment was ready for immediate transition, Dr. S. M. Scott, Sr., resigned as mayor of Terra Alta, W. Va., June 13. The difficulty arose over a quarrel between the mayor and the city sexton, the mayor being in favor of keeping the cemetery gates locked.

Personal Notes.

Dr. Calvin Anderson, mayor of Madison, N. J., died May 26, of heart disease.

S. Y. High has been appointed superintendent of the water department at Haines City, Mo.

Palmer Campbell has been reappointed a member of the County Park Commission, at Jersey City, N. J.

W. Mahlon Davis, of Berlin, Ont., has been appointed city engineer of Prince Rupert, British Columbia.

W. S. Sanford has been elected to fill out the unexpected term of Mayor Green, resigned, at Griggsville, Ill.

Col. Wm. H. Bixby has been appointed Chief of Engineers of the U. S. Army, in place of Gen. Wm. L. Marshall, retired.

Roy F. Weirick has been appointed landscape engineer in the department of parks and public buildings, at Des Moines, Ia.

Robert L. Burwell and Arthur L. Reeder have been appointed designing engineers on the water board, at Baltimore, Md.

George A. Hibbard, former mayor of Boston, Mass., died May 29, at his home in the Ashmont district, of tuberculosis, aged 46 years.

T. C. J. Bailey, Jr., head of street extensions, District of Columbia, has been appointed engineer of bridges, succeeding W. J. Douglas, resigned. J. W. Dare will have charge of the street extension work, under the direction of M. C. Hazen, district surveyor.

Leander Schadt has been appointed city engineer, and Ernest Hartman assistant city engineer and superintendent of streets at Cumberland, Md.

Henry A. La Chicotte, principal assistant engineer in the department of bridges, New York City, has been appointed deputy chief engneer.

N. P. Anderson, city surveyor of Brigham City, Utah, was drowned in the Logan river, June 4, while returning from a surveying expedition in Logan Canyon.

N. A. Carle, M. Am. Soc. M. E., Assoc. M. Am. Soc. C. E., has opened an office in Seattle, Wash., as a consulting engineer in mechanical, electrical and mining engineering.

H. von Schon, consulting engineer, Detroit, Mich., has been engaged by the West Indies Electric Company, Ltd., to prepare plans for a hydro-electric plant near Kingston, Jamaica.

A. J. McPherson, of the Saskatchewan Provincial Public Works department, and consulting engineer to the City of Regina, Sask., has been appointed one of the new municipal commissioners.

S. M. Gunn, head of the health department of Orange, N. J., for three years, resigned June 6 to accept a position in the sanitary engineering faculty of the Massachusetts Institute of Technology.

W. J. Douglas, M. Am. Soc. C. E., has resigned as engineer of bridges, District of Columbia, to become associated with William Barclay Parsons, consulting engineer, 60 Wall St., New York City.

Robert H. Fuller has been appointed a member of the New York State Water Supply Commission, succeeding Dr. Ernst Lederle, who resigned in January to become health commissioner of New York City.

Samuel Whinery, consulting engineer, New York City, has been retained by the commission on city expenditures of Chicago, to report on the present conditions and possible improvements in the street department.

The Morgan Engineering Co., 612 Goodwyn Institute Building, Memphis, Tenn., has been organized by Arthur E. Morgan and L. L. Hidinger, to practice hydraulic and drainage engineering, with special reference to the reclamation of swamp lands.

John Duder, Assoc. M. Am. Soc. C. E., and assistant city engineer of Salt Lake City for the last four years, has resigned to become chief engineer in charge of the practice of the Birch Company, engineers, of that city.

Prof. Ira H. Woolson of Columbia University, who has been in charge of the laboratory for testing building materials, especially by fire, has been appointed consulting engineer to the National Board of Fire Underwriters.

Thomas H. Ferguson has resigned his position as patent attorney for the Kellogg Switchboard & Supply Company, of Chicago, and has opened offices at 1443 Marquette Building, Chicago, for the practice of Patent Law.

George R. G. Conway, M. Am. Soc. C. E., formerly chief engineer of the Monterey Water & Drainage Co., of Monterey, Mex., has opened an office to practice as hydraulic and sanitary engineer, at 514 Paulsen Bldg., Spokane, Wash.

Charles E. Perkins has established an office at Akron, Ohio, and will practice civil engineering. Mr. Perkins retired, May 21, from the office of chef engineer of the public works of the State of Ohio, which position he held for 18 years.

Arthur H. Blanchard, M. Am. Soc. C. E., Associate Professor of Civil Engineering at Brown University, has recently resigned from the position of Deputy Engineer of the State Board of Public Roads of Rhode Island. Professor Blanchard will remain in Europe until after the sessions of 2nd Congres Internationale de la Route and continue his investigations of the construction and maintenance of bituminous surfaces and bituminous pavements.

The peculiar and difficult drainage problem of the city of Louisville, Ky., which several times a year has to endure flooding from the three-branched Beargrass Creek that flows through the eastern part of the city is the subject of a lengthy report by Harrison P. Eddy, civil engineer, of Boston, and J. B. Breed, chief engineer, of the city of Louisville. The work recommended consists in the construction of masonry lined channels for the creek, removal of obstruction by highway and railroad bridges, and some improvements in the sewer service.

MACHINERY AND TRADE

The Goodwin Portable Asphalt Plant.

W. S. Goodwin, Box 95, Times Square Station, New York City, has devised a convenient and satisfactory plant for heating and mixing asphalt pavement materials on the street of which the following is a description:

The heating and mixing drums are placed in a casing; in the same casing, immediately above are situated the two melting kettles. The entire interior of the casing is heated by fuel oil, giving a constant uniform temperature entirely around both drums, the bottom and four sides of the melting kettles.

As the entire casing or housing is lined with heavy asbestos, the full benefit of the heat generated by the fuel oil is obtained. The machine, being duplex, does the work of two machines; while the material is being heated and mixed in one drum other materials are being

placed in the other drum without the loss of time by laborers, thus allowing the drums to discharge the hot mixtures alternately.

Placed in front of the housing and on same frame, are the boiler and steam engine, or a fuel oil engine, whichever may be desired. The latter has the following advantages: $4.00 to $6.00 per day saved in fuel; no fuel expenses except during operation; no licensed engineer or fireman is required.

These fuel oil engines should not be confused with those using dangerous gasoline, naphtha, benzine or those having troublesome electric igniters and delicately exposed parts, as the crank shaft and other moving parts are entirely enclosed, making the machine dust proof and especially adapted to this class of work.

This plant is also equipped with a fuel oil tank having sufficient capacity for a day's supply for the engine, also a day's supply for heating the mixing drums and melting kettles.

An air compressor is supplied, also a tank for same, sufficiently large to operate the oil burner and agitate the material in the melting tanks. This compressor is directly connected and thoroughly protected from the weather. A water tank is provided for supplying water to either the oil engine or steam boiler.

In transporting the plant by rail the upper railing and the small stack are detached. The plant is then hauled on its own wheels to a flat car and by the use of skids from the end of the car and a block and tackle, the plant is placed on the car ready for shipment.

In operation the plant is placed on, or adjacent to, the roadway under construction and within wheeling distance for the barrows. Sufficient materials and supplies for two days' paving are placed convenient to the plant.

The proper proportion of the two or more different size stone and sand is measured in batches, in one of the several simple ways, and then shoveled into either one of the hoppers leading to the heating drums.

When the moisture has been driven off the sand and stone and they are sufficiently hot, the proper amount of hot bitumen is introduced into the same mixing drum by gravity from the measure placed on the opposite side from the stone and sand hoppers.

When the materials are thoroughly mixed and the proper temperature obtained, the door at the end of the drum is opened and the contents of the drum automatically discharged into wheel barrows placed on the side of the plant when they are immediately wheeled to the place of operation.

The man situated on the top of the housing attends to the placing of the stone and sand alternately into the drums, also runs the proper amount of hot bitumen from either tank in the measure.

The melting tanks are filled by the use of the lift on top of the housing, which brings the bituminous material from the ground and places it in the tanks, where it is melted and then run by gravity into the measure.

The drums, revolving independently of each other, are under the supervision of the plant engineer, who stops either one of them when the doors are opened or closed.

The capacity of any plant for heating and mixing materials of this class depends principally on the amount of moisture in the mineral aggregates, the melting point of the bitumen, the climatic conditions and the efficiency of the plant used.

Under ordinary conditions this plant will heat and mix 70 tons of a mixture composed of stone, sand and bitumen in ten hours, or 600 to 700 square yards of pavement.

Mr. Goodwin will send further information on request.

The Gas Directory.

Brown's "Directory of American Gas Companies" ($5) gives statistics about companies making all kinds of gas, well classified and arranged and with a new index, which makes the book even more convenient than heretofore. The 1910 edition has over 500 pages, at least a hundred more than the previous edition and gives every indication, after comparison with the last edition, of being strictly up-to-date. An interesting appendix of nearly 70 pages gives detailed information about a number of the large companies.

There are lists of members of the numerous gas associations and a list of books for gas men in other appendices. The book is even better worth its price this year than heretofore.

Minwax Waterproofing.

The Minwax Company, Townsend Building 1123 Broadway, New York, have a refinery in Brooklyn at which the product of their mine is received and refined under the supervision of A. B. Harrison, who has spent five years in the development of the product and has reduced the refining process to an exact science. Several grades of waterproofing are prepared for various conditions and uses, as follows:

Minwax below-grade waterproofing is a tough, flexible, elastic fabric saturated with Minwax and applied with Minwax hard waterproofing, swabbed or hot. It is intended mainly for subsurface work.

Minwax subway cloth No. 55 is impervious to gas-drip and like disintegrating conditions.

Minwax structural steel coating No. 100

is made in black and olive green and can not be removed from the metal except by solvents not prevalent in building construction.

Minwax damp-proofing No. 300, forms a tough, black, rubber-like waterproof skin over the suface, to which plaster will bind.

Minwax stone backing is similar, is applied with a brush also, and will prevent staining by Portland cement.

Minwax clear waterproofing is a clear mineral liquid which enters a porous surface and fills the voids.

There are also Minwax coatings No. 55, No. 200 and No. 500, for special applications to metal, wood, roofs, hot surfaces, etc., also vault light and bridge cements. The company will send full information and a book of specifications on request.

Removal of Fisher Hydraulic Stone and Machinery Co.

The Fisher Hydraulic Stone and Machinery Company, of Baltimore, Maryland, owing to a fire at their Eastern factory, has found it necessary to transfer both the manufacture of their machinery, and the general working force of the office to the western office at Mt. Gilead, Ohio, and from that point all business of the company will have prompt and careful attention. All communications should be addressed direct to the Fisher Hydraulic Stone and Machinery Company, Mt. Gilead, Ohio, saving delays of passing through the office in Baltimore to come before the general manager.

Drilling for Water.

A booklet published by the Keystone Driller Co., of Beaver Falls, Pa., gives a very valuable practical discussion of the subject of drilling wells for water, which should be read by every one interested in this subject. It shows the advantages of a drilled well over a dug well, and shows the conditions which may make a drilled well a flowing well.

Good arguments are made for starting a well for a domestic supply with a 5¾ or 6-inch pipe.

The defects in bored and driven wells, or in driving a small well to rock and then drilling are clearly stated. And the advantages of a large well for domestic service as storage for a small inflow of water are also shown.

The general principles of the art of drilling are detailed, with full descriptions of the tools and the methods of using them and the process of drilling is followed from the setting up of the machine through the handling of the tools, dressing the bits, handling the temper screw to the use of the sand pump and bailer. The writer knows of no more thorough treatment of the subject in print.

Then follow equally clear descriptions of all the parts of the Keystone drilling apparatus and its peculiar advantages, which is supplemented by a question department in which the usual questions of prospective purchasers are answered.

The second part is an illustrated descriptive catalog and price list. One interesting tool is a percussion core drill.

Even if one is not contemplating an immediate purchase he will find it worth while to send to the company for this catalog, No. 1.

Miracle to Marsh.

The business of the Miracle Pressed Stone Co., of Minneapolis, Minn., has been transferred to the Marsh Company of 970 Old Colony Building, Chicago, Ill., who will hereafter supply the long line of concrete and concrete block machinery developed by the former company. The Miracle brothers have long been identified with extensive contracting operations and will give their entire attention to that business. Mr. George C. Marsh is well known to concrete machinery interests, and the business will not suffer by the transfer, as he is probably as worthy a successor as the Miracle Company could have selected.

The Development of Wooden Stave Pipe.

BY SHIRLEY BAKER, M. AM. SOC. C. E., SAN FRANCISCO, CAL.

Although the first use of wooden pipe of the present day type is of comparatively recent date, bored logs were extensively used by our forefathers for carrying water under pressure. These log pipes, however, were made in small sizes, not exceeding four and five inches in diameter. Soon the increased demands of civilization called for larger conduits, and longer pipe lines to reach up into the mountains to the source of greater, purer supply. Necessity, therefore, developed the type of wooden pipe now being built, known as "continuous stave pipe," which is widely used in irrigation, penstocks for hydro-electric developments and municipal water supply, and is built in sizes from ten inches to ten feet, and more, in diameter.

This pipe is made up of a sufficient number of staves to complete the circle of desired diameter, each stave being "saw-kerfed" at the ends. In these saw-kerfs, or slots, are seated metallic tongues, which, when the staves are "driven back," form a tight butt joint. The seam joints between staves are made tight by banding the pipe with round steel rods, varying in size from three-eighths to one inch in diameter, depending on the size of the pipe. Each rod is made a complete band by means of a malleable iron shoe, or lug, engaging the headed and threaded ends, nut and washer of the rod. So the present type of wooden pipe differs materially from its bored log ancestor by being banded by these steel rods.

When asked as to the life of a "con-

tinuous stave pipe," some wooden pipe manufacturers cite the finding of the old bored logs in London, New York and many other places, where they have been "dug up," after perhaps a century in the ground, and the wood found to be in an almost perfect state of preservation. This, of course, is not a fair comparison, as the bored log presented no steel to corrode or rust away.

In considering the life of continuous stave pipe, let us first discuss the stave or wooden portion:

in as careful a manner as economically possible.

The writer's experience in wooden pipe construction covers a period of some eight years, and during this time effort has continually been made to find the most effective protective coating for the metal portions of wooden pipe, such coating to be tough, durable, to resist chipping or scaling off, and at the same time to be economical.

During the last six years, on the construction of a number of wooden pipe lines

WOODEN STAVE PIPE LINE IN PROCESS OF CONSTRUCTION.

So many structures have existed for years, depending for their stability on wooden piles or grillage placed below "low water mark" that it is accepted as a truth, "wood kept saturated with water will not rot." Therefore, under ordinary conditions, the life of continuous stave pipe, when kept constantly full, its staves saturated, becomes the life of the steel bands encircling it. The life of the steel bands can be greatly prolonged if the metal is covered with some protective coating. It is, therefore, of the utmost importance that this coating, to prevent corrosion, should be selected and applied

under his supervision, "Pioneer" mineral rubber pipe coating has been very successfully used as a hot dip for coating the bands, and "Pioneer" field paint as a cold application for retouching spots that become abraded during construction; both these materials being manufactured by the American Asphaltum and Rubber Co., of Chicago. Based on experience and use, the writer is unhesitating in his praise of "Pioneer" mineral rubber pipe coating and "Pioneer" field paint, as fulfilling effectively the rigid requirements of a protective coating on the metal portion of wooden pipe.

The Mueller Water Tapping Machine.

How long will Mueller water tapping machines last? The makers themselves cannot tell. They know that they will last for years. They know this fact so well that each machine is unconditionally guaranteed. That, of course does not mean that a machine will last a lifetime. Few articles manufactured for daily use will, yet it seems that the Mueller company could guarantee this and their machines would actually make the guarantee good.

At a recent National Convention of the American Water Works Association held in New Orleans, there was exhibited a Mueller water taping machine that had seen thirty years' hard service. With it were shown tools that had been used with the machine for eighteen years. The machine and tools were the center of much attention, and much favorable comment. The machine and tools were loaned for the exhibit by their owner, Mr. Frank Morrison of Bloomington, Illinois, who feels as much pride in the service this pioneer tapper has given him as does the company in the way it has upheld their reputation. The satisfaction that Mr. Morrison felt in his machine prompted a volutary letter to the Mueller company last January, in which he said:

I have in my possession one of your water tapping machines I have had in use for the past thirty years, never failing to make a tap on every water service installed by me in all these years. I can truthfully say this machine has not cost me for repairs, not to exceed $10.00, is now in first class condition and is good for a great many more years.

Specifications for the Bitu-Mass Pavement.

Following are the specifications for bitu-mass pavement, which has recently been added to the pavements for which bids are to be received for improving Indianapolis streets:

Foundation—The earth foundation or sub-grade will be brought to an even surface, parallel with the grade proposed for the pavement, by making the necessary excavation or embankment. Soft or spongy earth, or other material not affording a firm foundation, will be removed and the space refilled with dry earth, which shall be solidified by ramming or rolling. Any portion of the earth foundation not accessible to the roller shall be thoroughly compacted by ramming. When the rolling and ramming shall have been done, the surface of the earth foundation shall be true and smooth, and five (5) inches below the proposed finished surface of the pavement.

Excavated Material—The earth or other material excavated as hereinbefore described shall be placed in piles along the center or sides of the roadway thus excavated. This material shall contain approximately fifty (50) per cent. of mineral matter. (By mineral matter is meant gravel, broken stone, slag, etc.) If, in its original state, it contains less than this percentage, sufficient gravel, stone or slag shall be mixed with it to bring the aggregate up to this amount.

Gravel—Any gravel to be used shall be clean pit or river gravel. The same shall be screened and any particles removed that measure above one (1) inch in any direction.

Broken Stone—If broken stone is used, the same shall be a hard, sound and acceptable stone, and shall be a natural mixture of the various sizes as coming from the crusher, except that all stones above one (1) inch shall be removed.

Pavement—The completed pavement shall be five (5) inches in thickness and shall be made as follows:

The earth and mineral matter as above described shall, before being mixed with the bituminous cement, be passed through a rotary dryer and there subjected to direct heat for the purpose of expelling moisture, and for the further purpose of causing these ingredients to readily unite with the bituminous cement. Before being discharged from the dryer the earth and mineral matter shall be heated to a temperature of approximately 250 degrees. The bituminous cement to be heated to approximately the same temperature.

Bituminous Cement—The bituminous cement used in this mixture shall be carefully prepared pitch, made from the highest grade of coal tar obtained in the manufacture of gas, in which no petroleum, water gas or other enricher is used, and refined by such process and apparatus as will accomplish uniformity of result and remove, as far as practicable, light oil, naphthalene and other matter susceptible to atmospheric influences. No pitch that has been cut back or softened by the use of light oils shall be used, and no cement shall be used which contains in excess of 38 per cent. of sooty matter or free carbon, or less than 24 per cent. of the same. No pitch made from water gas, coke oven or process tars shall be used.

Any cement that, after pouring on a blotter while heated to 250 degrees F., and run out into a sheet, will crack when bent, after being plunged into water at a temperature of 45 degrees F., shall be rejected. The ductility and consistency of the cement shall be as follows:

1. If a cylinder of the pure cement, at the temperature of 75 degrees F., one-half inch in diameter and one inch long, be held between the fingers of each hand and stretched, the same shall draw into a strand at least 3 feet long without breaking.

2. The consistency or penetration of the cement shall be as follows: Take a metal cylinder 10 inches long and 2 inches in diameter, closed at one end, except a hole in the center of the bottom, into which a smaller metal cylinder, 1 inch long and ⅝-inch bore may be screwed, projecting into the larger cylinder ⅛ inch, with a standard thermometer fastened on the inside of the larger cylinder. Fill the small cylinder with a plug of the cement and screw in place; hang the cylinder in an upright position and fill with water at a temperature of 78 degrees F., and keep same at that temperature. If the water forces a hole through the cement in from 100 to 150 seconds, the consistency is suitable; otherwise, it shall not be used.

The bituminous cement shall at no time be heated to exceed 250 degrees F. When the compounding of the mixture is taking place, the mixture shall be of the temperature of between 180 and 250 degrees F.

The amount of the bituminous cement to be used is determined by the amount required to thoroughly coat each particle of the earth and mineral matter, and to fill the remaining voids in the mixture.

After the formula is thus obtained, giving the exact amount by weight of the earth and mineral matter and the exact amount of cement for one batch, the same shall simultaneously be dumped into the mixer and the whole compound thoroughly agitated until all the particles are thoroughly covered, and the combination is a uniform bituminous concrete.

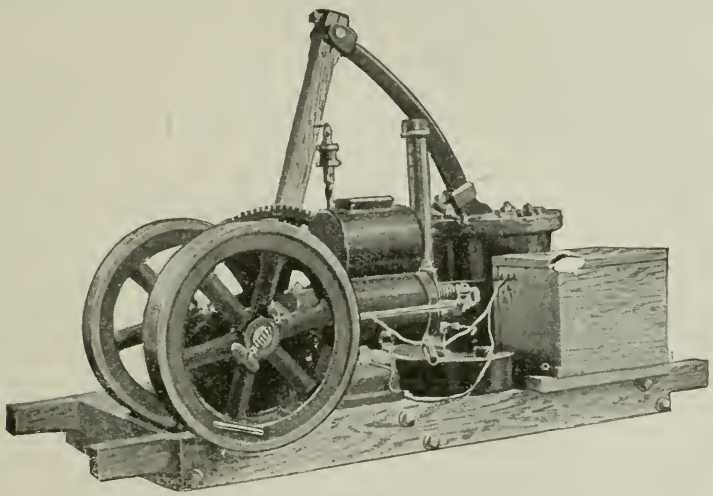
In this condition it shall be spread on the prepared foundation or sub-grade in two courses or layers, as follows: The first or lower course shall contain a slightly larger percentage of the cement than the second or upper course, and shall be at least three (3) inches in thickness after being thoroughly compressed by rolling with a steam roller weighing at least eight (8) tons. The second or upper course shall then be spread on top of the lower course to such a depth that, after thorough compression with a steam roller weighing at least eight tons, the two courses (or the entire pavement) shall have a thickness of five (5) inches.

Guarantee, Maintenance and Bond—All the conditions of sections 36, 37, 38 and 46 of the General Specifications in reference to guarantee, maintenance and bond for modern city pavements shall also apply to this pavement.

A Powerful Portable Trench Pump.

The accompanying cut shows a portable diaphragm bilge trench pump, operated by a strong 3-h.p. gasoline engine, which has some very strong points of advantage. Pump and engine are mounted on a strong skid, which is easily moved by means of the projecting handles.

The wrist pin on the gear wheel has four points of attachment, giving four different strokes, and the revolutions of the engine can be regulated to run the pump at 30 to 50 strokes a minute, and will pump from 3,000 to 3,500 gallons an hour. The pump is strong and simple in design, can be run night and day, and, it is claimed, will pay for itself on one job, being much more economical than one run by hand. Full information about the pump will be given by the manufacturers, the C. H. & E. Manufacturing Co., 321 Mineral st., Milwaukee, Wis.



A PORTABLE TRENCH POWER PUMP.

Contract for Bitulithic Pavement Awarded by New York State Highway Commission.

The long campaign to secure the improvement of Main street, through the village of Whitesboro, ended successfully when the State Highway Commission at Albany on May 27, awarded the contract to Warren Brothers of Boston for the construction of a bitulithic pavement 1.60 miles in length. The bid of Warren Brothers was $64,510, which was lower than any other bid presented for either brick or bitulithic pavement and lower than the estimated cost, which was $79,000. The list of bids received by the commission was as follows: Bitulithic—Warren Brothers' Company, Boston, $64,510.80; John R. Baxter, jr., Utica, $78,352; H. R. Baurgart Company, Buffalo, $70,000. Brick—Central City Paving Company, Syracuse, $72,000; James W. Johnston, Utica, $65,700; Frank L. Cohen, Buffalo, $72,400; John R. Baxter, Utica, $68,120; W. V. Bardol, Buffalo, $73,000; Harry W. Roberts, Utica, $67,870; H. R. Baurgart Company, Buffalo, $67,000.

President George Haynes, A. M. Waterbury, R. A. Jones and James Corbitt of Whitesboro appeared before the commission and urged the acceptance of Warren Brothers' bid, as the people of the village had signed a petition asking for bitulithic pavement. Warren Brothers are a well-known firm. They laid many of the asphalt pavements in Utica. Re-

cently they have been engaged in constructing bitulithic pavements and have put them down in many places, including Rome and Herkimer, where they have been thoroughly tried and have proved highly satisfactory.

With this new pavement the appearance of the village will be transformed, and as the state and the trolley company will pay the major part of the expense the burden upon the taxpayers will be easily borne. The pavement will begin at the Sauquoit Creek and extend to the westerly limit of the village.

The Cube Mixer for Concrete.

The Austin improved cube concrete mixer, by its change of name from the Chicago cube mixer, puts the credit for the machine where it belongs, for the Austin company, the Municipal Engineering and Contracting Co., has developed the machine and advertised it until it is now perhaps the best known of the concrete mixers, as it is the simplest in form and operation. It is made of numerous sizes and designs to suit all kinds of work, and is fitted with steam or gasoline power and with various hoppers and measuring boxes for supplying it with materials, so that the demands of any contractor can be met.

Its well-known freedom from any fixed or moving vanes or parts inside the cube, and consequent cleanliness, its thorough mixing of the concrete by the buffeting given it by the sides of the cube revolving on a line through opposite corners, have given it a pre-eminence which it is difficult for other mixers to reach. Ask the company for catalogs and full information at its office in the Railway Exchange Building, Chicago, Ill.

Validity of Bitulithic Patents Confirmed in Grand Rapids and Other Cases.

Following the decision in the Owosso case, of Mr. Justice Lurton, formerly the presiding Justice of the United States Circuit Court of Appeals for the Sixth Circuit, but now a member of the Supreme Court of the United States, Justice Denison of the United States Circuit Court for the Western District of Michigan has just entered a decree in the case of Warren Brothers Company vs. The City of Grand Rapids and Kloote and Van der Veen, Contractors, in which it is adjudged:

Claims 5, 6, 9 and 11 of said patent No. 727,505 are valid, and a pavement constructed under the specifications adopted by said City of Grand Rapids for the improvement of Lyon Street, Park Street and West Park Place, as set forth in the bill of complaint, would necessarily constitute an infringement of one or more of the claims of said patent.

That the defendants and each of them, their servants, agents, attorneys, workmen and employes, be and they hereby are perpetually enjoined and restrained from directly or indirectly making, using, vending, or selling to others to be used, said improvements and inventions as described and claimed in the 5th, 6th, 9th and 11th claims of said Letters Patent No. 727,505, or any material or substantial part thereof, except as to the construction of the pavement on the streets in said City of Grand Rapids hereinabove named, to-wit: Lyon Street, Park Street and West Park Place,

A license having been granted to Kloote & Van der Veen and royalty paid for the use of Warren patents on the streets above referred to.

This decree of Judge Denison is in line with the decrees heretofore entered by Judge Pollock against the Cities of Topeka and Emporia, Kansas, by Judge Jones in a suit against the Cities of Montgomery and Huntsville, Ala., and by Judge Meek in a suit against the City of Fort Worth, Texas, in all of which cases final decrees have been entered restraining the construction of street pavements infringing the claims of the Basic Patent, No. 727,505, under which the bitulithic pavement has been laid, the validity of which was finally adjudicated in the cases against the Cities of Owosso and Muskegon, reported in 166 Fed. Rep. 309, and confirmed by the Supreme Court of the United States May 24th, 1909.

A Machine for Washing Filter Sand.

The Stocker machine for washing concrete materials has an equally valuable use in cleaning the sand and gravel for filter beds. It is in successful use for that purpose in South Milwaukee, Wis. A full description of the operation of the machine will be found in the May number of MUNICIPAL ENGINEERING, p. 362. In brief, the sand or gravel is put in at one end of the revolving drum of the washer and is stirred up by the angle irons and steel strips, riveted on the inside, each of which forms a chute, serving at the same time as an elevator to carry the material to the upper side of the drum, whence it drops into the next chute to get another bath. As the water enters at the upper or discharge end of the drum each washing is in a cleaner water, until the sand is discharged clean into conveyor or bin. Ask the Stocker Concrete Material Washer Co., Highland, Ill., for full information about the uses and the economies of the machine.

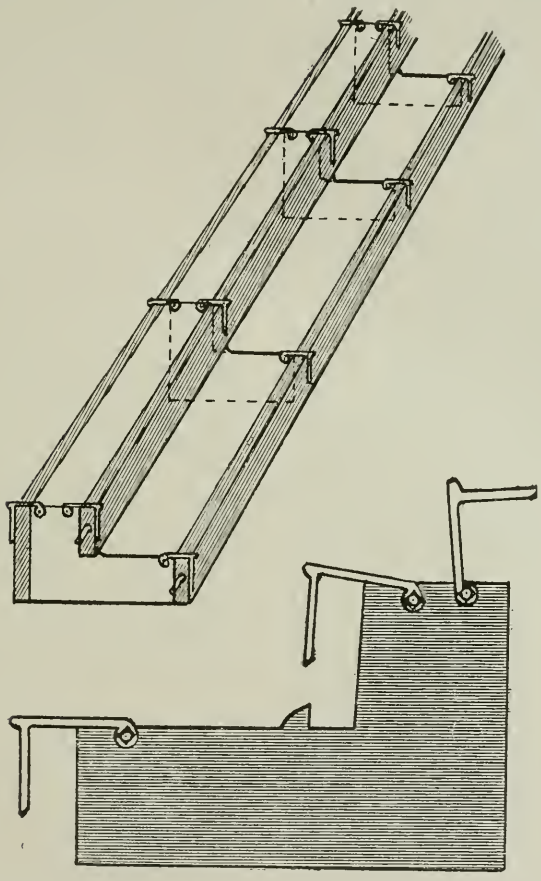
The Chicago Sewer Excavator.

The Chicago sewer excavator, made by the Municipal Engineering and Contracting Co., Railway Exchange, Chicago, Ill., has long been favorably known by contractors as one of the most efficient machines for digging trenches for sewers which has been devised. Its design covers all the points of difficulty with surprising completeness. It digs true to line and grade any material except solid rock, and size up to 5 feet wide and 27 feet deep. It digs sticky soils without

clogging, and permits sheeting of trenches in movable material close to the working face. It will remove any stone smaller than the trench and will pass over and dig around pipes that extend across the trench. It moves along the trench and from one job to another by its own power, and will travel over soft ground when equipped with its multipedal track device.

The company sells the machine outright or leases it on pay for work done by it.

The writer has seen the machine at work and confirms the claims of the makers as to its capabilities. Contractors and city officials should write to the company for full information.



SMITH'S PLATES AND CLAMPS FOR ARTIFICIAL CURB AND GUTTER.

Clamps for Concrete Curb and Gutter Forms.

The accompanying drawings show clearly the method of operation of the Smith patent rail clamps for concrete curb and gutter. The lower drawing of the two shows the division plate between sections of curb, with the clamps for holding in place the plank forms. The upper drawing shows four of these division plates in place with the planks for back of curb and gutter, front of curb and front of gutter, all in place and held there by the clamps. The solidity of the device, the convenience of its arrangement and the ease and certainty with which it can be operated can readily be seen. Stakes are done away with; a single man can withdraw the plates and finish the curb. Write to S. C. Smith & Son, Waverly, N. Y., for full statement of the excellencies and economies of the apparatus.

Supplying Individual Demands for Asphaltoilene.

The Good Roads Improvement Co., of Cincinnat,i has devised a special equipment for applying asphaltoilene to roadways by the barrel, to meet the requests for oil in small amounts to be used by private individuals, clubs, improvement

associations and the like for the treatment of comparatively small areas.

The equipment consists of a special double-acting oil force pump set over the bung of the barrel of asphaltoilene, a 2-foot section of 1½-inch suction pipe, 25 feet of special oil-proof hose, end capped with brass couplings, an adjustable brass oil sprayer, a skid or frame with adjustable clamps, equipped with wrought iron hooks, to fit any size of barrel. The sprayer is specially adapted to use with asphaltoilene. A man at the pump and one with the sprayer can oil from 2,100 to 2,800 square yards of roadway in a day.

A neighborhood can club together, rent an outfit, buy enough oil, and hire a couple of laborers, and thus get rid of the dust nuisance next to them, and, since the makers claim that a single application asphaltoilene will settle the dust for a year, the trouble is soon over and the expense is light, less than sprinkling with water and more continuous in its effect. The company will give full information on request to its Cincinnati office in the First National Bank Building.

The Manual of Statistics.

The 1910 edition of *The Manual of Statistics* has just appeared, being the thirty-second annual issue of that standard publication. Changes of great interest and importance have taken place during the past year in corporate affairs in the United States and Canada, as well as in the capital and obligations of different railroad and industrial organizations. The 1086 pages of this handsome and compact volume present a greater fund of information for the use of investors and speculators than can be obtained in any other work of the kind. At the same time it covers ample information regarding government securities, mining stocks and the grain and cotton statistics. Its utility is further enhanced by an arrangement rendering references to the different sections easy and satisfactory. The edition also devotes much attention to the newer railroad or industrial companies, and gives the many changes in dividend payments which have occurred down to date of its issue. It presents throughout evidence of accuracy and careful compilation, and is brought down to date in its descriptive and statistical details, making the volume one which investors and all who are interested in the financial and other markets of the country cannot afford to be without. It is published by The Manual of Statistics Company, 20 Vesey Street, New York. Price, $5.00.

Trade Publications.

The Steel Protected Concrete Co., Real Estate Trust Bldg., Philadelphia, Pa., is distributing a handsome black and gold desk ruler as an advertiser of the Wainwright galvanized steel corner bar for protecting the edges of concrete curbs, steps, columns, etc.

The Edison Aggregate for May is mainly devoted to garages, and so is Bulletin No. 73 of the Universal Portland Cement Co., of Chicago.

An illustrated booklet of interest to city officials has been received from The Firestone Tire & Rubber Co. describing their dual pneumatic tire demountable rim equipment for use on automobile fire engines, ambulances, patrol wagons, etc. The Firestone company recommend this equipment as the most effective means of preventing tire delays in reaching fires and making other quick runs. Copies of the booklet will be mailed upon request.

J. A. & W. Bird & Co., Boston, issue a pamphlet on the waterproofing of structures with special reference to sub-level construction, the envelope method and the application of "tunaloid."

Two recent booklets of the Northwestern Expanded Metal Co. give designing data and describe the construction of highway bridges.

Catalog No. 6 of the Keystone Driller Co., Beaver Falls, Pa., is devoted to the Downie deep-well pumps, of which this company now supplies a full line of double and single geared and steam pumps, double stroke windmill pumps and combined pumps.

S. C. Smith & Son, Waverly, N. Y., describe in a brief and clear circular their patent rail clamps and division plates for sidewalk, curb and gutter forms and add a price list of the various sizes, which is of much interest to the sidewalk contractor.

The June publication of the Indianapolis office of the Lehigh Portland Cement Co., is filled with demonstrations of the value of cement and concrete drain and sewer tile.

The Osborn Engineering Co., Osborn Building, Cleveland, O., issue a handsome large book illustrating the many manufacturing and power plants, bridges and buildings which they have designed and constructed.

Reinforced concrete for houses is the subject of a recent pamphlet of the Vulcanite Portland Cement Co.

Geo. H. Holzbog & Bro., Jeffersonville, Ind., successors to the U. S. Sanitary Co., issue a handsome new catalog of their odorless steel vehicles for garbage, night soil, ashes, etc.

The Carb-Ox Co., Rogers Park, Chicago, Ill., send a catalog of their complete line of gas analysis instruments and allied specialties.

Buffalo-Pitts steam rollers are fully shown in a series of handsome circulars and catalogs of the Buffalo Steam Roller Co., Buffalo, N. Y.

Modern centrifugal pumps are the subject of a recent catalog of R. D. Wood & Co.

Forty-one reasons why concrete should be selected to the exclusion of any other type of construction are clearly given by DeWitt V. Moore, C. E., in a recent bulletin of the Lehigh Portland Cement Company.

The Thomas Moulding Co., Chicago, Ill., issues a booklet on "Artistic Brick and the Textile Principle in Brick Work," which is so artistic that it makes the reader feel sure that the brick it is intended to exploit will produce equally artistic results in the structures in which it is used. It is supplemented by a series of blotters of similar design.

Trade Notes.

ASPHALT.

Spokane, Wash.—This city has a new asphalt plant. Its capacity is 1,400 sq. yds. of asphalt daily, and it cost the city $14,490.

BRICK.

Galesburg, Ill.—The Purington Brick Co. has opened a second brick yard.

Mechanicsville, N. Y.—The Ferris Paving Brick Co. has changed its name to the Mechanicsville S. S. Brick Co.

CEMENT.

Cleveland, O.—The Gulf States Portland Cement Co. has been incorporated by W. B. Whiting, T. M. Kirby, J. Walworth Sutphin, Sterling Newell and C. C. Owens.

Sault Ste. Marie, Mich.—Surveys for a site for the Great Lakes Portland Cement Co. which will build a cement plant here, will begin soon.

St. Louis, Mo.—The McCormick Waterproof Portland Cement Co. has been incorporated by Theresa K. McCormick, William J. Brennan, Chauncey Vennewitz and J. P. McDonough.

Port Washington, N. Y.—The Magnesia Cement Co. has been incorporated by Harry R. H. Nichols, Frank Poggenburg, William H. Russell, Frank Collins and Charles Jackson, of New York City.

Gilmore City, Ia.—A company is being organized to construct a cement plant, with a capacity of 5,000 barrels a day.

CONCRETE BLOCKS.

Chickasha, Okla.—The Chickasha Cement Burial Co. has been organized by J. A. Rose, F. M. Frey, E. S. Dugan.

Waterloo, Ia.—The Cement Products Co. has been organized, with H. S. Raymond as president; Howard A. Sharp, vice-president; Ernest E. Schenk, secretary; W. H. Stewart, treasurer.

Plainfield, Ia.—J. J. Hullman is considering the question of installing a cement plant here.

Toronto, S. D.—Lauris & Peter Larson and Gus Anderson have established a plant for the manufacture of cement goods, using a thresher engine for power.

Fox Lake, Wis.—J. C. Williams and John Rogers have opened a cement block plant.

Neenah, Wis.—R. O. Sindahl is introducing the construction of block cement sidewalks here.

Lewiston, Idaho.—The Lewiston Glazed Pipe Co. has been organized recently to manufacuture cement pipe for irrigation purposes.

Biggsville, Ill.—The Biggsville Cement & Block Works will have a capacity of 12,000 cement brick per day. James Kilgore is at the head of the company.

Brooklyn, N. Y.—The Home Concrete Block Co. has been incorporated by Harrison Rockefeller, 332 Lenox Road, and Hans Skomfoe, 1684 Nostrand Ave., of Brooklyn, and Justin W. Smith, 60 Wall St., New York City.

Chicago, Ill.—The Lock Bar Steel Concrete Co. has been incorporated by C. F. Rathburn, R. M. Ashcraft, and E. M. Ashcraft, Jr., all of this city.

Brooklyn, N. Y.—The Greenpoint Cement Works Co. has been incorporated by Francisco Franzese, 43 Havermeyer st.; Amillo Franzese, 67 N. 6th st.; Francisco Pasuci, 309 N. 7th St.

Le Roy, Minn.—The Le Roy Cement Culvert Co. has been organized to push the sale of a culvert built in sections, invented by Gilbert Mahoney and Frank A. Rounds.

Milbank, S. D.—The Milbank Cement Construction Co. contemplates beginning the manufacture of cement tile, cement fence posts, building blocks, etc., about July 1.

Watertown, S. D.—H. A. Witzel will engage in the manufacture of hollow blocks with W. B. Vaughn, at Beach, N. D.

Olympia, Wash.—Sylvester & Gliddin have established a concrete building block plant at Sunnyside, Wash.

PURCHASE OF MACHINERY.

New York City.—(Special).—The Municipal Engineering & Contracting Company, manufacturers of trenching machines, have removed their offices in this city to 30 Church St.

Sacramento, Cal.—(Special).—Jenkins & Wells, 3530 Y st., desires to purchase a steam pile hammer.

Stuttgart, Ark.—(Special).—The Kress Construction Co. advises us that it desires to purchase cement machinery.

Denison, Tex.—(Special).—Roy M. Finley, secretary Denison Live Wires, contemplates the purchase of a complete set of street cleaning apparatus, sweepers, sprinklers, etc., and will appreciate catalogues and other data. The organization also desires data regarding vacuum street cleaners.

East Aurora, N. Y.—(Special).—A. Brotherhood, vil. prest., desires information regarding apparatus for pumping out cess-pools.

Portland, Ore.—(Special).—The Public Works Engineering Co., Beck Bldg., advises us that it is in the market for about 75,000,000 fire brick; roof tiling; 2 sets wagon scales; 2 recorders; temperature testing apparatus; 1 150 ft. chimney; 2 150-h. p. water tube boilers; 4 blower fans; 4 engines; steel dumping cars for incinerator, at Vancouver, B. C.

PURCHASE OF MATERIALS.

El Dorado, Kan.—(Special).—C. W. Buskirk advises us that he desires to purchase reinforcing materials.

MISCELLANEOUS.

Texarkana, Texas.—The plant of the International Lumber & Creosoting Co. was destroyed by fire, June 1, three weeks after its completion, entiling a loss of $600,000 to $900,000. The fire was caused by an explosion of gas in a tank containing 45,000 gals. of creosote.

Lafayette, Ind.—The Wabash Gravel Co. has been incorporated by L. R. Bissel, A. McQueen and G. R. Thompson.

Greenfield, O.—The San Mixing Machine Co. has been incorporated by V. E. Minick, E. L. McClain, F. B. James, Fay Baldwin and Charles Maiur.

Chicago, Ill.—The Kelly-Atkinson Construction Co., a bridge building firm with

offices at 188 Madison st., has purchased 2½ acres of land at Rondout, Ill., and will locate its plant and a large warehouse there.

New York, N. Y.—The Hayden Machinery & Supply Company, New York, has just moved into suite 53 Hudson Terminal Building, where the company will have larger quarters to facilitate the handling of its rapidly increasing business.

Mr. George B. Foster has been appointed Chicago Sales Manager for the Wisconsin Engine Co., with offices in the Fisher Building.

The Birch Company, Inc., engineers, with offices in Salt Lake City, Utah, Bozeman, Mont. and Fargo, No. Dak., have engaged the services of Mr. John Duden, Assoc. M. Am. Soc. C. E., four years, assistant city engineer, Salt Lake City, to act as chief engineer on hydraulic and irrigation projects. The company's practice will cover municipal, water supply, hydraulic and irrigation projects. General office is in the Felt Building, Salt Lake City.

SEWER PIPE.

Dennison, O.—The Dennison Sewer Pipe Co. has been incorporated by Theodore Lanning, W. L. Birney, Maurice Moody, Jas. J. Mazurie, W. K. Eckfeld, P. R. Rosing, and E. F. Utterback. The company will manufacture sewer pipe.

Patents Concerning Mixers and Conveyors for Concrete and Concrete Materials.

857,742. Measuring and Mixing Machine. Andrew Lanquist, Chicago, Ill.

858,017. Machine for Mixing Concrete. Geo. M. Pence, Topeka, Ind.

860,031. Concrete Mixer. Walter L. Jones, Stevenville, Mich.

862,848. Concrete Mixing Machine. Leonard C. Roberts, Samuel G. McTarnaghan and Wm. H. Jeffs, Nunda, N. Y.

863,775. Concrete Mixer. Frank W. Blakeslee, Ashtabula, O.

864,386. Machine for Mixing Materials for Concrete. Wm. H. Peters, Columbus, O.

864,449, 864,450, 864,451. Conveying and Mixing Machines. Lewis K. Davis, New York, N. Y.

865,150. Mortar Mixer or Hoe. Niels Anderson, Philadelphia, Pa.

865,365. Mixing Apparatus. Chester T. Drake, Chicago, Ill.

866,056. Concrete Mixer. Allen R. Parker, Akron, O.

868,762. Process of Manufacturing Concrete. Wm. D. Crow, E. Orange, N. J.

869,522. Machine for Mixing Concrete. Geo. D. Scheiffler, Jackson, Mich.

870,797. Concrete Mixer. Arthur W. Ransome, New York, N. Y.

871,363. Concrete Mixing and Molding Apparatus. Charles R. Schmidt, Baltimore, Md.

872,610. Mixing Machine. Roy N. Cunningham and John W. McPherson, Columbus, O.

872,729. Mixing Machine. Geo. Hiller, Teplitz, Austria-Hungary.

873,455. Mortar Mixer. Curt E. Oelman, Detroit, Mich.

876,270. Concrete Mixer. R. B. Fulton, Red Cloud, Neb.

876,466. Method of Preparing and Storing Concrete. Juergen H. Magens, Hamburg, Germany.

877,918. Cement Mixing Machine. Franklin J. Emal, Pickrell, Neb.

879,808. Concrete Mixer. Herman Besser, Alpena, Mich.

881,236. Concrete Mixer. Frederick B. Gulgow, Flandreau, S. D.

882,830. Concrete Mixer. John D. Luttrell, Benton Harbor, Mich.

883,498. Machine for Mixing Concrete and the Like. Thos. L. Smith, Milwaukee, Wis.

883,983. Concrete Mixing Machine. Ralph T. Sollitt, Chicago, Ill.

884,667. Concrete Mixer. Philip A. Koehring, Milwaukee, Wis.

884,698. Apparatus for Mixing Concrete. John F. D. Withrow, Ottawa, Ont.

885,448. Unloading Apparatus for Concrete Mixers. Harold Davis, Washington, D. C.

886,018. Concrete Mixing Machine. Robert J. Selentine, Cleveland, O.

886,434. Concrete Mixer. John H. Stewart, Waterloo, Iowa.

886,680. Concrete Mixer. Jas. F. Crowe, Burnside, Ky.

886,768. Concrete Mixer. Progore P. De Bogory, Larkin, Fla.

887,854. Concrete Mixer. Arthur E. Schenck, Bethany, O.

888,118. Cement Mixer. Albert J. Remley, Crawfordsville, Ind.

888,198, 888,199. Concrete Mixer. Geo. J. Stafford, McGraw, N. Y.

888,975. Concrete Mixing Apparatus. Chas. B. Dunn, Almond, Ala.

890,086. Rotary Mixer for Concrete. Paul Olson, Stoughton, Wis.

890,641. Concrete Mixing Apparatus. Peter C. Hains, Sr., Washington, D. C.

891,345. Concrete Mixer. Samuel Knisley, Phillipsbury, Kan.

891,756. Concrete Mixer. Geo. P. White, Wallace, Idaho.

892,239. Concrete Mixer. John Fish, South Bend, Ind.

892,399. Concrete Mixer. John Carlen, Havana, N. Y.

892,496. Concrete Mixing Apparatus. Alfred G. Alexson, Orleans, Neb.

892,630. Concrete Mixer and Conveyor. John B. Thies, Dayton, O.

894,749. Apparatus for Mixing Concrete. Alfred von Siller, Washington, D. C.

894,813. Concrete Conveyor. Josiah W. Buzzell, E. Orange, N. J., and Wm. H. Larkin, Jr., Worcester, Mass.

895,651. Concrete Mixer. Chas. C. Lorenz, Denver, Col.

896,616. Concrete Spreader. James E. Briggs, Waterloo, Iowa.

897,313. Mixing Machine. Wm. O. Stark, Chicago, Ill.

898,171. Mixing Machine. Chas. E. Bathrick, Chicago, Ill.

898,958. Concrete Mixer. Theo. H. Bolte, Kearney, Neb.

899,071. Cement or Concrete Mixer. James A. Randall, Detroit, Mich.

899,414, 899,415. Concrete Mixer and Drum. Philip A. Koehring, Milwaukee, Wis.

899,547. Concrete Mixer. Norman E. Marsh, Des Moines, Ia.

901,024. Concrete Mixer. Jas. E. McKeon, Wilkes-Barre, Pa.

901,340. Concrete Mixer. Anson R. Hannaford, Traverse City, Mich.

903,426. Concrete Mixer. Wm. Wolter, Burress and Herman H. Stottko, Fairmont, Neb.

903,516. Mixing Machine (Concrete). Wm. O. Stark, Chicago, Ill.

905,092. Mixer. Archibald E. McNitt, Chicago, Ill.

905,375. Mixing Apparatus. James C. Shreffler, Chicago, Ill.

906,282. Mixing Machine. Wm. S. Plummer, St. Louis, Mo.

906,908. Mixer. Abner M. Monday, Knoxville, Tenn.
907,284. Concrete Mixer. Evan B. Ravencroft, Mishawaka, Ind.
907,297. Mixing Machine. Frank A. Sicklesteel, North Branch, Mich.
908,120. Concrete Mixer. Alexander D. Ney, Aurora, Ill.
909,134. Combined Mixer and Sprinkler for Making Roads. Bennett N. Beard, Shelton, Conn.
912,125. Concrete Mixer. Walter E. Hassam, Worcester, Mass.
913,425. Cement Mixer. Alfred G. Olsen, Elkhorn, Wis.
914,291. Portable Concrete Mixer. Boudinot G. Leake, Ft. Worth, Tex.
915,703. Elevator for Beton Mixing Machines. Albert Schwyzer, Balsthal, Switzerland.
920,415. Mixer Feed Device. Chas. E. Bathrick, Chicago, Ill.
920,416. Concrete Mixer. Chas. E. Bathrick, Chicago, Ill.
920,958. Concrete Mixer. Daniel E. Jones, Detroit, Mich.
921,480. Concrete Mixer. David Stevens and Samuel L. Thomas, Minneola, Kan.
922,112. Mixing Machine. Robert Edmondson, Mt. Vernon, O.
922,724. Mortar Mixer. George D. Scheiffler, Jackson, Mich.
922,860. Concrete Mixer. Milon J. Demorest, Belding, Mich.
923,868. Concrete Mixer and Spreader. Peter J. Lyback, Chicago, Ill.
925,744. Mortar Mixer. Perry L. Blystone, Cambridge Springs, Pa.
926,171, 926,172. Measuring and Feed Mechanisms for Concrete Mixers. Lawrence W. Cargill, Columbus, O.
927,117. Concrete Mixer. Warren D., Everett S., John G. Clough, Quincy, Ill.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Knoxville, Tenn.—The county road commission has appropriated $72,000 for the construction of pikes.

Sour Lake, Tex.—Voted to issue $35,000 bonds for the improvement of roads in road precinct No. 2.

Wharton, Tex.—The question of paving Milam st. is being considered.

Quincy, Ill.—Council has decided to contest granitoid sidewalks in the business district.

Union, Ore.—Council has passed an ordinance providing for 16 blks. of concrete walks.

Corydon, Ind.—The town board has authorized the construction of concrete sidewalks in certain streets.

St. Paul, Minn.—Paving is contemplated for Dayton ave.

Bicknell, Ind.—This city is planning to pave the streets.

Radford, Va.—Voted to issue $25,000 bonds for street improvements.

McPherson, Kas.—A petition is being circulated for paving Maple st.

Muscatine, Ia.—The establishment of a new paving district is proposed.

Caldwell, Idaho.—Will vote July 7 on the issue of paving and water bonds.

Chariton, Ia.—Final action will be taken July 14 on the proposed brick paving.

Bemidji, Minn.—Bonds have been voted for street improvements, including paving.

Plymouth, Ind.—The estimated cost of improving the Michigan road is $30,000.

Aberdeen, Wash.—The city council has passed an ordinance for grading Hume st.

Eldora, Ia.—City council contemplates paving 6 blocks of streets this year.

De Land, Ill.—Plans and estimates are being prepared for paving ⅝ miles of street.

Sioux Falls, S. D.—Plans have been prepared for paving 6th st. with Jasper blocks.

Bellevue, Pa.—A resolution has been passed for improving Brighton and W. Bellevue roads.

St. Petersburg, Fla.—Will vote July 19 on the issue of bonds for paving the street with brick.

Little Rock, Ark.—Plans are being formulated for resurfacing Center st. from 12th to 18th sts.

Spokane, Wash.—Plans have been completed for 471,913 sq. ft. of concrete paving in 2nd ave.

Chehalis, Wash.—The construction of a concrete road between Chehalis and Centralia is contemplated.

Mexia, Tex.—The construction of about 100 miles of macadamized roads in this vicinity is proposed.

Hutchinson, Kas.—A resolution has been adopted providing for 1½ miles of street and alley paving.

Wharton, Tex.—Shell paving is contemplated for Milam st. from the Court House to the Southern Pacific depot.

Parsons, Kan.—An ordinance has been passed providing for the paving of 21st st. between Morgan and Briggs aves.

Hoquiam, Wash.—A resolution has been passed for clearing Sumner ave. and covering it with rock and gravel.

New Westminster, B. C.—This city will vote July 14 on the issue of $324,500 bonds for street improvements.

South Pasadena, Cal.—Bids will be asked for soon for grading and curbing and constructing cement gutters in Palen ave.

Groesbeck, Tex.—This county will vote July 9 on the issue of bonds for constructing 50 mis. or more of macadam roads.

Jonesboro, Ark.—The paving commission has decided to pave the business

streets in district No. 4 with Pittsburg blocks.

Houston, Tex.—Petitions are being circulated for paving a number of streets in the 5th ward with shell.

Ft. Wayne, Ind.—City engineer Randall is preparing uniform plans for cement sidewalks between the railroads in Calhoun st.

Cedar Rapids, Ia.—A resolution has been passed to pave Grand ave. with brick block on concrete base. L. J. Story, cy. clk.

Duluth, Minn.—The board of public works contemplates the construction of concrete walks in 5th ave. through the wholesale district.

Philadelphia, Pa.—Preliminary plans for a boulevard to Roxborough have been prepared by Chief Webster of the Bureau of Survey.

Omaha, Neb.—The question of paving the downtown district with asphalt, instead of brick, is being discussed. Cy. engr. Craig.

Portland, Ore.—Plans are being prepared for paving Kenton district, about 8 blocks of hard pavement, with 12-ft. sidewalks.

Shiner, Tex.—An ordinance was passed June 8 for issuing $10,000 bonds for street improvements and extension of the water works system.

Osceola, Ia.—City council voted, June 13, to pave blocks of streets, aggregating 12,000 sq. yds. of paving and 41,000 ft. of curbing.

Atchison, Kan.—Resolutions have been passed for paving alley block 2, 8th, Riley and Hickory sts. with brick. S. K. McCrary, cy. engr.

Athens, O.—Ordinances have been adopted for improving Campbell and Stimpson aves. Brick or block paving is contemplated for State st.

Augusta, Ga.—This city has decided to construct about 7000 sq. yds. of vitrified brick paving in Ellis st. and Cotton alley. Mayor Barrett.

San Angelo, Tex.—City engineer Goodfellow has been directed to establish a grade line in the business section preparatory to paving Chadbourne st.

Richmond, Tex.—Road bonds for $150,000 have been approved for building a shell road from the Brazos river to the Harris county line below Missouri City.

Wenatchie, Wash.—The city council passed resolutions providing for the construction of sidewalks in Bolenbaugh & Engineers' addition, at a cost of $33,718.

Atlanta, Ga.—Cy. engr. Clayton has been directed to ask for bids for wood block paving in Marietta st. Tile or cement walks are also proposed for Marietta st.

Martin, Tex.—This city voted, June 7, to accept the new law passed by the last legislature authorizing towns to do street paving and make other improvements.

Los Angeles, Cal.—Mayor Alexander has signed an ordinance regulating the manner in which local railway companies shall pave and keep in repair their tracks on paved streets.

Montgomery, Ala.—Mayor Gaston Gunter signed ordinances June 15, providing for mineral rubber paving in Mobile st. and asphalt paving in Bibb and Monroe sts. W. F. Black, cy. clk.

Red Oak, Ia.—Special.—The bids submitted June 8 for 56,000 sq. yds. of bituminized macadam with curbing were rejected and the city clerk directed to ask for bids on 25,000 sq. yds. brick paving on concrete base and 17,000 ft. of curb. Theo. S. DeLay, engr. in charge, Creston, Ia.

Memphis, Tenn.—Bids will be asked for soon for paving Cooper, East, Anderson, Latan, Porter and S. Lauderdale sts., Waldran boulevard, Monroe and Chelsea aves. and Miller place with asphalt. Jefferson ave. will be paved with wood block and a number of other streets with tar macadam later.

CONTRACTS TO BE LET.

Quincy, Cal.—Bids are asked until July 8 for constructing a road. Co. clk.

Red Cloud, Neb.—Bids are asked until July 7 for constructing 13 street crossings.

Paoli, Ind.—Bids are asked until July 5 for constructing roads. U. B. Ham, co. audt.

Seward, Neb.—Bids are asked until July 6 for brick block paving. Mel Gordon, cy. clk.

Salem, Ind.—Bids are asked until July 5 for constructing roads. Sam G. Ellis, co. audt.

Columbus, Ind.—Bids are asked until July 8 for constructing gravel roads. John M. Davis, co. audt.

Richmond, Ind.—Bids are asked until July 8 for constructing a macadam road. D. S. Coe, co. audt.

Grand Junction, Colo.—Bids are asked until July 5 for constructing a county road. Bd. co. comrs.

Marion, Ind.—Bids are asked until July 8 for constructing a road. A. Y. Stout, co. audt.

Minneapolis, Minn.—Bids are asked until July 5 for repairing road No. 7. Hugh R. Scott, co. audt.

Lebanon, Ind.—Bids are asked until July 8 for constructing gravel roads. B. F. Herdrich, co. audt.

Decatur, Ind.—Bids are asked until July 6 for constructing a macadam road. H. S. Michand, co. audt.

Sullivan, Ind.—Bids are asked until July 5 for constructing a gravel road. Ben C. Crowder, co. audt.

Winamac, Ind.—Bids are asked until July 5 for constructing 2 roads. Ellis S. Rees, co. audt.

Tipton, Ind.—Bids are asked until July 5 for constructing gravel roads. J. F. Barlow, co. audt.

Kentland, Ind.—Bids are asked until July 5 for constructing gravel roads. Elmer R. Brigham, co. audt.

Bloomington, Ind.—Bids are asked until July 6 for constructing a highway. Horace Blakely, co. audt.

Newport, Ind.—Bids are asked until July 11 for constructing a gravel road. H. T. Payne, co. audt.

Frankfort, Ind.—Bids are asked until July 9 for constructing gravel roads. Chas. F. Cromwell, co. audt.

Concord, N. H.—Bids are asked until July 8 for constructing trap rock roads. H. C. Hill, State engr.

Muncie, Ind.—Bids are asked until July 6 for improving a public highway. Jos. E. Davis, co. audt.

Fairmont, Minn.—Bids are asked until July 12 for constructing gravel roads. H. P. Edwards, co. audt.

Versailles, Ind.—Bids are asked until July 5 for constructing macadam roads. Nicholas Volz, co. audt.

Greencastle, Ind.—Bids are asked until July 5 for constructing 4 macadam roads. D. V. Moffett, co. audt.

Princeton, Ind.—Bids are asked until July 6 for improving 13 public highways. Wm. T. Roberts, co. audt.

Schuylkill Haven, Pa.—Bids are asked until July 5 for paving streets with vitrified brick. Geo. W. Butz, engr.

Vernon, Ind.—Bids are asked until

Ft. Slocum (New Rochelle, P. O.), N. Y.—Bids are asked until July 12 for constructing roads, sidewalks, curbs, gutters and drains. Constr. Q. M.

Indianapolis, Ind.—Bids are asked until July 6 for paving 36th st. from Pennsylvania st. to Central ave. with bitumass. C. A. Schrader, prest. B. P. W.

Santa Barbara, Cal.—Bids are asked until July 5 for the construction and extension of Mountain Drive in Dist. No. 2. C. A. Hunt, clk. co. bd. supvrs.

Lake City, Fla.—Bids are asked until July 12 for constructing 16,000 sq. yds. of vitrified brick paving and 5 mls. of cement walks. J. W. Layne, secy. B. P. W.

Charleston, S. C.—Bids are asked until July 8 for gravel paving at the Navy Yard. R. C. Hollyday, chm. bureau of yds. and docks, Navy Dept., Washington, D. C.

Crawfordsville, Ind.—Bids are asked until July 4 for grading, graveling and constructing cement curb and gutters and cement sidewalks in Mills Place. Fred B. Robinson, cy. clk.

Broad Ripple, Ind.—Bids are asked until July 5 for constructing concrete sidewalks in Broadway ave. and 61st st. Dr. Geo. Hesler, prest. town bd.; Fletcher Johnson, clk. town.

Verona, N. J.—Bids are asked until July 11 for grading and paving Pleasant Valley Way with bituminous telford, from this borough to West Orange, a distance of 4 mls. Wallace Oughether, dir. freeholders. 312 Court House, Newark, N. J.

Glen Gardner, N. J.—Bids are asked until July 7 for constructing 1 mi. of macadam road on the State lands adjoining the N. J. Sanatorium for Tuberculous Diseases.

Indianapolis, Ind.—Bids are asked until July 5 for grading and graveling and constructing cement walks on lot surrounding 2 school buildings. J. E. Cleland, bus. dir. bd. school comrs.

Woodruff Place, Ind.—Bids are asked until 8 p. m., July 2, for resurfacing the East, Middle and West Drives with wood block, asphalt, bitulithic, bitu-mass and bitu-mineral. Frank Goheen, town clk.

Hoosick Falls, N. Y.—Bids are asked until July 8 for 900 sq. yds. brick paving; 2700 sq. yds. bituminous macadam; 68,-200 sq. ft. concrete sidewalks; 5600 sq. ft. driveways; 4660 lin. ft. concrete curb and gutter; relaying 7500 sq. ft. flag sidewalk; July 8. W. Thomas Wooley, vil. engr.

Glasgow, Ky.—Bids are asked until July 12 for constructing 7250 sq. yds. of bituminous macadam paving, and 7,250 sq. yds. of water-bound macadam pavement; 2400 or 4800 ft. 18-in. concrete gutters; 1850 cu. yds. earth excavation and refilling; building culverts and laying drain tile. Paul Greer, cy. clk.

Galveston, Tex.—Bids are asked until July 5 for constructing 4,000 sq. yds. of sidewalks, 2,200 ft. concrete curbing and 2,350 ft. concrete retaining curb. John M. Murch, co. audt.

Louisville, Ky.—Bids are asked until July 7 for 17 blocks of paving. Bd. public safety.

Wooster, O.—Bids are asked until July 5 for paving Quincy ave. H. F. Crowl, clk. B. P. S.

Elizabeth City, Va.—Bids are asked until July 5 for paving the street. St. paving com.

Oklahoma City, Okla.—Bids are asked until July 5 for paving 31st, 32nd, 33rd, Hill Eubank and 35th sts. with petrolithic. Bon Panman, cy. clk.

Columbus, O.—Bids are asked until July 5 for constructing 21.6 mis. of pike road. T. L. Thomas, co. audt.

Evansville, Ind.—Bids are asked until July 19 for resurfacing 4th and Division sts. Harry Stinson, co. audt.

Port Byron, Ill.—Bids are asked until July 5 for constructing 1750 ft. cement sidewalk. B. B. Huntley, vil. clk.

Vincennes, Ind.—Bids are asked until July 5 for constructing gravel roads. T. Scott, co. audt.

Rushville, Ind.—Bids are asked until July 5 for constructing a macadam road. Jesse M. Stone, co. audt.

Lafayette, Ind.—Bids are asked until July 7 for constructing a gravel road. John P. Foresman, co. audt.

Canton, O.—Bids are asked until July 6 for 1 mi. of brick paving in Lexington twp. J. H. McConnell, co. audt.

Wausau, Wis.—Bids are asked until July 15 for 8000 sq. yds. of creosoted block paving. B. C. Gowen, cy. engr.

Burlington, N. J.—Bids are asked until July 5 for constructing a gravel road. Geo. A. McCoy, chm. road com.

Delphi, Ind.—Bids are asked until July 5 for improving highways in Deercreek and Jackson twps. M. G. Haun, co. audt.

Cincinnati, O.—Bids are asked until July 8 for widening road on Harris ave., Mt. Washington. Fred Dreihs, clk. co. comrs.

Mt. Holly, N. J.—Bids are asked until July 5 for constructing a gravel road. Harry E. Dubell, dir. bd. chosen freeholders.

Flemington, N. J.—Bids are asked until July 8 for constructing 17,802 ft. of macadam road. J. W. Sharp, dir. bd. chosen freeholders.

Washington, D. C.—Bids are asked until July 9 for paving streets and avenues with sheet asphalt and asphalt block. Dist. Comrs.

Port Byron, Ill.—Bids are asked until July 5 for constructing 1750 lin. ft. 4-ft. cement sidewalk. B. B. Huntley, vil. clk.

Cincinnati, O.—Bids are asked until July 5 for improving the Harrison and New Haven road. Stanley Struble, prest. co. comrs.

Anderson, Ind.—Bids are asked until July 7 for constructing 3 gravel and 1 asphalt road with asphalt binder. A. L. Smith, co. engr.

Brooklyn, N. Y.—Bids are asked until July 6 for paving and constructing sidewalks in various streets. Alfred E. Steers, prest. boro.

Crown Point, Ind.—Bids are asked until July 5 for constructing cement curbing in North st. Herman J. Lehman, clk. town bd. trustees.

Baltimore, Md.—Bids are asked until July 14 for constructing a section of State Aid highway. E. Stanton Bosley, secy. highway com.

Indianapolis, Ind.—Bids are asked until July 6 for constructing cement sidewalks in a number of streets. C. A. Schrader, chm. B. P. W.

Indianapolis, Ind.—Bids are asked until July 6 for constructing cement sidewalks in Grace and Ruckle sts. C. A. Schrader, chm. B. P. W.

Des Moines, Ia.—Bids are asked until July 6 for paving 35th st. with asphalt, requiring 4000 sq. yds. of paving. James R. Hanna, mayor.

Anderson, Ind.—Bids are asked until July 11 for constructing 4346 sq. ft. cement walk and 1000 lin. ft. curb and gutter. G. A. Pampher, cy. engr.

Ft. Madison, Ia.—Sealed bids are asked until 7:30 p. m. July 2 for grading and curbing with cement concrete, 5th st. L. G. Kiel, cy. clk.

July 5 for constructing sidewalks in a large number of streets. H. S. Holton, dir. pub. service.

Davenport, Ia.—Bids are asked until July 5 for paving with asphalt, 17th, 18th and Iowa sts. A. M. Compton, chm. B. P. W.

David City, Neb.—Bids are asked until July 13 for constructing 20 or more cement crossings. F. S. Meyers, cy. clk.

Fullerton, N. D.—Bids are asked until July 11 for constructing 2 road grades. Fred R. Applequist, cy. audt.

Loup City, Neb.—Bids are asked until July 19 for cement crossings and sidewalks. Cy. clk.

Marinette, Wis.—Bids are asked until July 18 for paving 9th st. Cy. clk.

Seward, Neb.—Bids are asked until July 10 for paving, guttering and curbing in dist. No. 1. Mell Gordon, cy. clk.

Sleepy Eye, Minn.—Bids are asked until July 5 for cement crossings and gutters. H. C. Peterson, cy. recdr.

Hoosick Falls, N. Y.—Bids are asked until July 8 for constructing 68,200 sq. ft. concrete sidewalks; 5600 ft. concrete driveways; 4660 lin. ft. concrete curb and gutter; 7500 sq. ft. flags relaid; 90 sq. yds. vitrified brick paving; 2700 sq. yds. bitumen macadam. Sanford L. Cluett, secy. impvt. com.

Columbus, O.—Bids are asked until July 6 for grading and macadamizing 2.32 mis. of road in Richland Co.; until July 7 for grading and paving with brick 1.5 mi. of road in Columbiana Co.; until July 8 for grading and paving with brick 1.08 mi. of road in Wayne Co. Jas. C. Wonders, State highway comr.

Peoria, Ill.—Bids are asked until July 5 for paving an alley with vitrified brick, requiring the following: 600 cu. yds. exca.; 1840 lin. ft. curb; 1769 sq. yds. brick paving; 1769 sq. yds. sand cushion; 1769 sq. yds. sand filler; 1769 sq. yds. gravel foundation. Geo. F. Simmons, prest. bd. local impvts.

Waukesha, Wis.—Bids are asked until July 11 for paving White Rock ave., East Park ave., and Cook st. with tar macadam with combination concrete curb and gutter; Lincoln ave. and Center st. with brick on concrete base between the tracks of a double track railway and with tar macadam between tracks and gutters. Morgan R. Butler, cy. engr.

CONTRACTS AWARDED.

Galveston, Tex.—J. C. Kelso was awarded the contract for paving the boulevard.

Riverside, Cal.—The contract for improving Mulberry st. was awarded to the Johnson-Shea Co. for $9,370.

Cincinnati, O.—Edward Ryan secured the contract for improving Montgomery Pike with granite, for $43,720.

Dayton, O.—Sellers & Schmitthauer secured the contract for grading and graveling Reasor ave. for $4,031.

Mt. Gilead, O.—Brady, O'Connel & Malloy secured the contract for constructing the Westfield road, for $20,464.

Lansdowne, Pa.—The United Paving Co. of Atlantic City, N. J., was awarded a contract, June 3, for paving Baltimore ave., for $58,000, with bitulithic.

Lethbridge, Alta.—The Forest City Paving Co. was awarded a contract for 27,000 sq. yds. of cement paving.

Duluth, Minn.—P. McDonnell was awarded the contract for paving Garfield ave. with sandstone, for $99,000.

Washington, Ind.—The contract for constructing a gravel road was awarded to N. H. Wilson, for $2,647.50.

Rolla, Mo.—The contract for paving Pine st. was awarded to Likes Bros., of Springfield, at $2.34 a sq. yd.

Michigan City, Ind.—The contract for constructing a macadam road was awarded to W. B. Hutchinson, for $8,080.

Vernon, Ind.—The contract for constructing a pike road was awarded to J. M. Childers, of Grammer, Ind., for $3,093.

Billings, Mont.—James Kennedy, of Fargo, N. D., secured the contract for paving in this city, aggregating $200,000.

Lebanon, Ind.—The contract for constructing a gravel roadway was awarded to Geo. T. Miller, of this city, for $18,407.40.

Little Rock, Ark.—The Memphis Asphalt & Paving Co. was awarded the contract, June 14, for resurfacing Center st.

Cincinnati, O.—Ed Ryan was awarded the contract, June 11, for paving Elberon ave. with granite, for $184,208.50.

Beloit, Wis.—The contract for street paving was awarded to the Western Improvement Co., of Racine, for $66,767.48.

Maysville, Ky.—The contract for street improvements was awarded to Kelly Bros. of Portsmouth, O., for $19,000.

Winamac, Ind.—The contract for constructing a road was awarded to Jerry Anderson, of Medaryville, Ind., for $1,040.

Dallas, Tex.—Special.—The contract for 9,645 sq. yds. of bitulithic paving was awarded to the Texas Bitulithic Co.

Baltimore, Md.—Special.—The contract for 5600 sq. yds. of bitulithic paving was awarded to Warren Bros. Co., of Boston.

Whitesboro, N. Y.—Special.—The contract for 24,700 sq. yds. of bitulithic paving was awarded to Warren Bros. Co., of Boston.

New Bedford, Mass. — Special. — The contract for 13,900 sq. yds. of bitulithic paving was awarded to Warren Bros. Co., of Boston.

Jackson, Miss.—Special.—The contract for 12,000 sq. yds. of bitulithic paving was awarded to the Southern Bitulithic Co.

New Castle, Pa.—The contract for paving Elm st. was awarded, June 14, to the Woods & Golder Construction Co., for $3,252.10.

Brazil, Ind.—The contract for constructing a road was awarded to L. W. Gibben & Son, of Saline City, Ind., for $8,080.

Peoria, Ill.—J. W. Bushnell was awarded the contract, June 16, for resurfacing Bradley ave. with asphalt, for $12,110.50.

Nanaaimo, B. C.—The contract for constructing 8 mis. of concrete walks was awarded to W. H. Worswick, of Victoria, B. C.

New Westminster, B. C.—The contract for cement walks was awarded to the Pacific Contracting & Investment Co., for $13,297.

Albany, Ore. — Special. — The Warren Construction Co., of Portland, secured the contract for 22,275 sq. yds. of bitulithic paving.

Atlanta, Ga.—Special.—Warren Bros. Co., of Boston, Mass., secured the contract for 20,000 sq. yds. of bitulithic paving here.

Rome, N. Y.—Special.—The contract for 13,578 sq. yds. of bitulithic paving was awarded to Warren Bros. Co., of Boston, Mass.

Brantford, Ont.—Special.—The Warren Bituminous Paving Co., of Toronto, was awarded a contract for 3500 sq. yds. of paving here.

Virginia, Minn.—Special.—H. L. Bartlett, of this city, was awarded a contract for 26,000 sq. yds. of bitulithic paving here.

Waco, Tex.—Special.—The contract for 25,000 sq. yds. of bitulithic paving was awarded to the Texas Bitulithic Co., of Dallas.

Abilene, Tex.—Special.—The Texas Bitulithic Co., of Dallas, was awarded a contract for 20,000 sq. yds. of bitulithic paving here.

Ft. Worth, Tex.—Special.—The Texas Bitulithic Co., Dallas, secured the contract for 20,000 sq. yds. of bitulithic paving here.

Ft. Worth, Tex.——Special.—The contract for 26,200 sq. yds. of bitulithic paving was awarded to the Texas Bitulithic Co., of Dallas.

Harrison, N. J.—Special.—The J. F. Shanley Co., of this city, was awarded the contract for 6,554 sq. yds. of bitulithic paving.

Little Falls, N. Y.—Warren Bros. secured the contract for bitulithic paving with curbing in N. 2nd st., for $1519.60, June 17.

Indianapolis, Ind.—John Arnold secured the contract, June 15, for constructing cement walks in Gray st., at 16 cts. a sq. ft.

Benwood, W. Va.—The contract for 7000 ft. of curbing in the 4th and 5th wards was awarded to W. H. McClain, of Bellaire, O.

Creston, Ia.—Hailton & Schwartz, of Shenandoah, Ia., were awarded the contract, June 3, for curbing and asphaltic paving in Adams st.

Racine, Wis.—The contract for paving Carlisle ave. with asphalt was awarded to the White Construction Co., at $1.97 a sq. yd.

Peoria, Ill.—James S. Allen was awarded the contract for paving certain alleys, June 7, for $1911, and Bryan ave. for $10,108.42.

Prescott, Ariz.—The Johnson-Shea Co., of Riverside, Cal., was awarded the contract for constructing 13 mis. of road, for $24,000.

Elyria, O.—The contract for 7000 sq. yds. of asphalt block paving was awarded to the Andrews Asphalt Paving Co., of Hamilton, for $15,550.

Toronto, Ont.—Special.—The contract for 24,083 sq. yds. of bitulithic paving was awarded to the Warren Bituminous Paving Co., of this city.

Asheville, N. C.—Special.—The Atlantic Bitulithic Co., of Richmond, Va., was awarded the contract for 12,000 sq. yds. of bitulithic paving.

El Paso, Tex.—Special.—The Texas Bitulithic Co., of Dallas, was awarded the contract for 22,354 sq. yds. of bitulithic paving.

Springfield, Mass.—Special.—The Warren Bros. Co., of Boston, was awarded the contract for 3300 sq. yds. of bitulithic paving.

Peoria, Ill.—John W. Bushnell was awarded the contract for paving Barker ave. from Moss to Western ave., with asphalt, for $12,119.50.

Galveston, Tex.—The contract for paving Commercial ave. with crushed stone, with concrete curb and gutter, was awarded to Goulson & Davis.

Lansdowne, Pa.—Special.—A contract for 21,000 sq. yds. of bitulithic paving was awarded to the Standard Bitulithic Co., of New York City.

East Orange, N. J.—Special.—The Standard Bitulithic Co., of New York City, was awarded the contract for 23,800 sq. yds. of bitulithic paving.

Bartlesville, Okla.—Special.—The Kansas Bitulithic Co., of Kansas City, Mo., secured the contract for 8,000 sq. yds. of bitulithic paving here.

Wadesboro, N. C.—The contract for paving the streets and sidewalks was awarded to E. P. Lindsay, of Portsmouth, Va., for about $30,000.

Chicago, Ill.—The Barber Asphalt Paving Co. was awarded a contract, June 10, for asphalt street repairs, at 76 cts. a sq. yd. for resurfacing.

Dallas, Tex.—The Texas Bitulithic Co. was awarded contracts, June 13, for bitulithic paving in Reiger and Carroll aves., at $2.30 a sq. yd.

Robinson, Ill.—The contract for paving the public square with brick was awarded to Allan Parrish, of Paris, Ill., for about $11,000.

Elgin, Ill.—The McCarthy Improvement Co., of Davenport, Ia., was awarded the contract for paving Spring st. with mineral rubber, for $52,875.

Tacoma, Wash.—The Barber Asphalt Paving Co. was awarded the contract for paving S. L, S. 8th, S. 9th and S. 10th sts. with asphalt, for $50,264.

Delaware, O.—H. N. Oberlander, of Marion, O., secured the contract for improving 4.7525 mis. of grading, draining and macadamizing, for $24,845.

Shreveport, La.—The contract for constructing 40,000 sq. yds. of creosoted wood block paving was awarded to the Gulfport Creosoting Works, for $50,000.

Syracuse, N. Y.—F. J. Baker was awarded contracts, June 4, as follows: Asphalt paving with stone curb, Dewitt st., $6,679.90; Oxford st., $6,150.75.

Albert Lea, Minn.—Fielding & Shepley secured the contract, June 8, for paving Main st. with creosoted wood blocks, at $2.28 a sq. yd. or $28,324.44.

Little Rock, Ark.—The M. D. L. Cook Construction Co. was awarded a contract, June 6, for paving W. 6th st. with asphalt, at $1.87 a sq. yd., or $42,077.

Superior, Wis.—The contract for constructing several blocks of sidewalks in the East End was awarded to E. Hawarden, at 62 cts. a lin. ft.

Lexington, Ky.—The contract for paving Limestone st. with brick was awarded to Kelly Bros., of Portsmouth, O., at $1.85 a sq. yd., or about $20,000.

Mishawaka, Ind.—Special.—The contract for constructing 5,000 sq. yds. of bitulithic paving was awarded to the Western Construction Co., of Lafayette, Ind.

Minersville, Pa.—The contract for paving Sunbury st. with brick was awarded, June 2, to the McConnell & Fitzpatrick Co., of Pittston, at $2.19 a sq. yd.

Indianapolis, Ind.—The contract for constructing cement walks in Georgia st. from Noble to East, was awarded, June 8, to Marion Caldwell, at 14 cts. a sq. yd.

St. Louis, Mo.—Special.—The contract for constructing 3,251 sq. yds. of bitulithic paving was awarded to the Granite Bituminous Paving Co., of this city.

Southport, Ind.—The contract for constructing 3127 ft. of cement sidewalks was awarded to H. W. Thielking, of Indianapolis, at 43¾ cts. a lin. ft.

Bloomington, Ill.—The Andrews Asphalt Co., of Hamilton, O., was awarded the contract for paving W. Washington and S. Main sts. with asphalt, at $1.28 a sq. yd.

San Diego, Cal.—The Knight & Hyde Construction Co. was awarded a contract for constructing a 25-ft. disintegrated granite road at Ft. Rosecrans, for $25,151.

Shelbyville, Ind.—The contract for street improvements in the industrial and Ray additions was awarded to Meloy & Porter for $366,690.19 and $16,917.13 respectively.

Trenton, Mo.—The contract for paving

High and Water sts. and E. College ave. with brick was awarded to Gates & Holbrook, of Kansas City, Kan., for more than $37,000.

Grosse Pointe Farms, Mich.—Special.—The contract for constructing 27,750 sq. yds. of bitulithic paving was awarded to the Central Bitulithic Paving Co., of Manistee, Mich.

Denver, Colo.—The Pueblo Construction Co. was awarded the contract for grading, curbing and surfacing the streets in Arlington Park, including 33 blocks, for $80,805.

Creston, Ia.—Special.—The contract for constructing 2200 sq. ft. of 4-ft. cement walks was awarded, June 13, to Wm. Rutledge & Co., of this city, at 11½ cts. a lin. ft.

Bloomfield, Ind.—Contracts for constructing gravel roads have been awarded as follows: J. H. Blackwell, Jr., of Sandborn, Ind., $1,785; J. P. Wright & Co., of Bloomfield, $6,199.87.

Portland, Ore. — Special. — The Pacific Bridge Co., of this city, secured contracts for 24,338 sq. yds.; the Warren Construction Co., of this city, a contract for 59,686 sq. yds. of bitulithic paving.

Shreveport, La.—The Filbertine Paving Co. was awarded the contract for bitulithic paving, and the Hot Springs Co. the contract for wood block paving. The total cost of the contracts reaches $600,000.

Utica, N. Y.—The Barber Asphalt Paving Co. was awarded contracts for paving McQuade and Downer aves. with asphalt with stone curbing, June 4, as follows: Downer ave., $10,819.80; McQuade ave., $8,904.85.

York, Pa. — Paving contracts were awarded, June 17, as follows: S. George st., sheet asphalt, $1.78, and W. York ave., $1.69 a sq. yd., Filbert Paving Co.; E. Market st., asphalt, $1.67, Central Supply & Construction Co.

Virginia, Minn.—Paving contracts were awarded, June 7, as follows: Maple st. and Central ave., bitulithic, H. L. Bartlett Co., $2.50 a sq. yd.; avenue leading from Chestnut st., P. McDonnell, creosoted wood blocks, $2.62 a sq. yd.

Centerville, Ia.—The contract for brick paving was awarded to McGuire & Stanton, of Leavenworth, Kan., as follows: Brick paving, $2.03 a sq. yd.; grading, 30 cts. a cu. yd.; combined curb and gutter, 52 cts. a lin. ft.

York, Pa.—Special.—The Standard Bitulithic Co., of New York City, was awarded the contract for 14,466 sq. yds. of bitulithic paving, and the Juniata Paving Co., of this city, secured a contract for 4300 sq. yds. of bitulithic paving.

Montreal, Que.—Contracts were awarded, June 6, as follows: Asphalting sidewalks, Sicily Asphalt Co., $1.83 a sq. yd.; asphalt sidewalks, Bitulithic Paving Co., $1.83; furnishing 25,000 sq. yds. of New York bluestone, F. D. Lawrence.

Wichita, Kan.—The Newell & Drayer Construction Co. was awarded the contract, June 6, for paving, curbing and guttering 11 blocks of Emporia ave. with brick, at $1.81 a sq. yd.; 22½ cts. a ft. for curbing, and 32½ cts. a ft. for gutter.

Wabash, Ind.—The contract for constructing a gravel road on the line dividing Wabash, Huntington and Whitley counties, and on the line between Wabash and Huntington counties, was awarded to Wm. Reffert, of Monroeville, Ind., for $11,900 and $19,111 respectively.

Scranton, Pa.—The McDonaldson Construction Co. was awarded the contract for paving Hickory st. with asphalt and stone block, and W. Market st. with asphalt; Warner-Quinlan Co., of Syracuse, N. Y., Green Ridge st., asphalt; Wm. Brown Co., Webster ave., stone blocks.

Hickory, N. C.—The contract for constructing new streets and cement sidewalks was awarded to Hart, Abee & Co., of this city, for $55,498. Tarvia X will be used for improving the streets.

Springfield, O.—Paving contracts have been awarded as follows. Yellow Springs st., sheet asphalt with Bolin brick between car tracks, $61,043.40, and McCreight ave., $17,098.40, Peters Bros., of Chicago; Pleasant st., asphalt block, Toledo Asphalt Block Co., $10,321.50.

Marion, Ind.—L. C. Lillard was awarded a contract for constructing the Soldiers' Home boulevard, at $5.49 a lin. ft., and O. I. Simmons the contract for the 38th st. boulevard, for $36,970. The L. M. Cole stone road will be constructed by James Crosby Co., of Bluffton, for $7,167.

Detroit, Mich.—Contracts for paving various streets have been awarded as follows: Collins st., concrete, R. D. Baker Co., Home Bank Bldg., $33,993; Hart ave., cedar, T. E. Currie, 345 Penn. ave., $12,494; St. Paul ave., Sec. 2, cedar blocks, W. W. Hatch & Co., Hammond Bldg., $7,868; sec. 1, cedar blocks, $2,572.

Wabash, Ind.—Gravel road contracts have been awarded as follows: Lester road, Frank Reed, of Liberty Mills, $12,000.50; Badger extension, Landis & Wilson, of Marion, $2,000; Schults-Ryan road, Huffman & Addington, of Huntington, $10,640; Maumee road, C. J. McGreevey & Sons, $10,970; Thrush road, Huffman & Addington, $5,360.

Peru, Ind.—Contracts for constructing gravel roads were awarded, June 8, as follows: James M. Little, Indianapolis, Ind., $7,446; James F. Pierce, Delphi, Ind., $2,900; C. M. King, Tipton, Ind., $6,500 and $7,800; Ted McKinney & Co., Sheridan, Ind., $8,997.

Ft. Wayne, Ind.—The Barber Asphalt Paving Co. was awarded the contract, June 10, for paving John st. as follows: Asphalt paving, $1.68 a sq. yd.; brick paving between car tracks and 12 ins. outside, $2.20 a sq. yd.; excavation, 45 cts. a cu. yd.; curbing, 57½ cts. a lin. ft. Bids have been received for paving certain alleys and constructing cement sidewalks, but were not taken under advisement.

Bloomington, Ill. — Paving contracts were awarded, June 6, as follows: I. D. McLain, section of Main st., Danville brick, $1.84½ a sq. yd.; stone curbing, 60 cts. a lin. ft.; resetting stone curbing, 6 cts. a lin. ft.; c. i. crossing plates, $11 each. Andrews Asphalt Paving Co., section of Main st., asphalt, $1.28 a sq. yd.; curb wall plastering, 3 cts. a lin. ft.; Washington st., asphalt, $1.28; combined curb and gutter, 50 cts. a lin. ft.

Seattle, Wash.—Contracts were awarded, June 10, as follows: Market st., grading, Rowan & Anderson, $5,616; North Broadway, grading and concrete walks, N. D. Johnson, $17,878; Fourth ave., paving, to Holt & Jeffery, Hinckley Block, $86,447; 20th ave., S., asphalt paving, Independent Asphalt Paving Co., Seattle Theatre, $52,619; N. 46th st., concrete walks, Great Western Fuel Co., 2523 4th ave., $9,728.

Boise, Idaho.—Bids were submitted, May 28, for paving, as follows: Asphalt, (a) without guarantee, (b) with 5-year guarantee—Coast Contracting Co., 1718 Pacific st., Tacoma, Wash., (a) $324,708, (b) $346,894; P. J. McHugh, Third and Mercer sts., Seattle, Wash., (a) $327,892, (b) $327,892; Pacific Paving Co., Seattle,

Wash., (a) $301,761, (b) $316,552; Barber Asphalt Paving Co., Boise, (a) $302,600, (b) $317,391. Concrete—J. Gustoffson, Boise, $225,076; Coast Contracting Co., Tacoma, $227,159; P. J. McHugh, Seattle, $254,008. Granitoid, (a) without guarantee, (b) with 5-year guarantee, (c) with 10-year guarantee—R. S. Biome Co., 79 Dearborn st., Chicago, Ill., (a) $373,607, (b) $381,003, (c) $395,794. Bitulithic, (a) stone base without guarantee, (b) stone base with 5-year guarantee, (c) stone base with 10-year guarantee, (d) concrete base without guarantee, (e) concrete base with 5-year guarantee, (f) concrete base with 10-year guarantee —Warren Construction Co., Portland,Ore., (a) $350,392, (b) $360,746, (c) $375,537, (d) $365,183, (e) $375,537, (f) $390,328. No bids were received for brick paving. Karl Paine, prest. B. P. W.

Albany, N. Y.—Contracts for repaving and resurfacing State and county roads were awarded, June 6, as follows: Repair Contract No. 76, Loudon Road No. 119, Section 2, Albany County: T. F. Shaughnessey Co., Albany, N. Y., $24,400 (awarded contract on residuum).

Repair Contract No. 78, Delmar-Slingerland Road No. 92, Albany County: Alonzo Schaupp, Albany, N. Y., $10,789 (awarded contract on residuum).

Repair Contract No. 65, Olean-Allegany County Highway No. 601, Cattaraugus County: F. V. E. Bardol, Buffalo, N. Y., $6,500 (awarded contract on Bermudez).

Repair Contract No. 56, Owasco County Highway No. 383, Cayuga County: Brayer Bros., Auburn, N. Y., $10,341 (awarded contract on residuum).

Repair Contract No. 67, Moravia-Niles County Highway No. 591, Cayuga County: Brayer Bros., Auburn, N. Y., $17,907 (awarded contract on Bermudez).

Repair Contract No. 68, Green-Smithville Flats County Highway No. 218, Chanango County: Albert Gaffey, Syracuse, N. Y., $5,800 (awarded contract).

Repair Contract No. 55, Cuyler County Highway No. 40, Cortland County: Chambers & Grady, Rochester, N. Y., $2,808 (awarded contract on Bermudez).

Repair Contract No. 62, Orchard Park, County Highway No. 272, Section 5, Erie County: John E. Johnson, Buffalo, N. Y., $6,913 (awarded contract on residuum).

Repair Contract No. 63, Transit County Highway No. 89, Section 2, Erie County: All bids rejected.

Repair Contract No. 83, Gloversville-Mayfield County Highway No. 33, Fulton County: John E. Burns & Co., Boston, Mass., $37,964 (awarded contract on Bermudez).

Repair Contract No. 49, Redwood-Alexandria Bay County Highway No. 182, Jefferson County: J. P. Cunningham, Plattsburgh, N. Y., $1,164 (awarded contract on Bermudez).

Repair Contract No. 50, Watertown-Sacketts Harbor-Henderson County Highway No. 181, Jefferson County: J. P. Cunningham, Plattsburgh, N. Y., $21,960 (awarded contract on Bermudez).

Repair Contract No. 57, Hamilton County Highway No. 81, Section 2, Monroe County: Wood, Tompkins & Truesdale, Hilton, N. Y., $4,390 (awarded contract).

Repair Contract No. 58, Scottsville County Highway No. 79, Section 2, Monroe County: Niagara Construction Co., Corning, N. Y., $20,613 (awarded contract on residuum).

Repair Contract No. 59, Clifton County Highway No. 78, Section 1, Monroe County: Wood, Tompkins & Truesdale, Fulton, N. Y., $4,390 (awarded contract).

Repair Contract No. 60, Scottsville County Highway No. 63, Section 1, Monroe County, Whitmore, Rauber & Vicinus, Rochester, N. Y., $11,945 (awarded contract).

Repair Contract No. 61, Ridge County Highway No. 6, Section 1, Monroe County: Wood, Tompkins & Truesdale, Fulton, N. Y., $7,785 (awarded contract on residuum).

Repair Contract No. 75, West Mohawk River County Highway No. 108, Montgomery County: Alonzo Schaupp, Albany, N. Y., $9,700 (awarded contract on residuum).

Repair Contract No. 85, Amsterdam-Minaville County Highway No. 32, Section 1, Montgomery County: John E. Burns & Co., Boston, Mass., $10,673 (awarded contract on Bermudez).

Repair Contract No. 48, Deerfield County Highway No. 3, Oneida County: Utica-Paris, County Highway No. 71, Oneida County: Aetna Engineering & Construction Co., Herkimer, N. Y., $41,400 (awarded contract on Bermudez).

Repair Contract No. 52, Fabius-Apulia County Highways Nos. 49, 75, 121, Sections 1, 2 and 3, Onondaga County: Joseph H. Conners & Co., Fulton, N. Y., $15,940 (awarded contract).

Repair Contract No. 53, West Lake County Highway No. 48, Marcellus-Marietta County Highway No. 74, Onondaga County: C. T. Hookway, Syracuse, N. Y., $10,360 (awarded contract on Bermudez).

Repair Contract No. 51, Gorham-Stanley County Highway No. 203, Naples-Atlanta County Highway No. 204; Naples-Woodville County Highway No. 205, Ontario County: C. Aikenhead Co., Rochester, N. Y., $14,258.68 (awarded contract on residuum).

Repair Contract No. 54, Honeoye-Hemlock County Highway No. 191, Ontario County: Albert Gaffey, Syracuse, N. Y., $6,660 (awarded contract).

Repair Contract No. 86, Gilbertville-Mt. Upton County Highway No. 314, Otsego County: Spuyten Duyvil Construction Co., New York, $15,080 (awarded contract).

Repair Contract No. 80, Albia-Wynantskill County Highway No. 77, Rensselaer County. All bids held.

Repair Contract No. 84, Troy-Brunswick County Highways Nos. 10, 25, Sections 1 and 2, Rensselaer County: County Construction Co., Troy, N. Y., $15,381 (awarded contract on residuum).

Repair Contract No. 79, Glens Falls-Saratoga County Highway No. 58, Section 1, Saratoga County: All bids held.

Repair Contract No. 81, Waterford County Highway No. 59, Section 2, Saratoga County: All bids held.

Repair Contract No. 82, Waterford County Highway No. 39, Section 1, Saratoga County: Kennedy & Easton Contracting Co., Albany, N. Y., $1,576 (awarded contract).

Repair Contract No. 72, Saugerties-Woodstock County Highways Nos. 37, 38, Sections 1 and 2, Ulster County: John E. Consaulis, Albany, N. Y., $46,916 (awarded contract on residuum).

Repair Contract No. 73, Kingston-Rifton County Highway No. 116, Ulster County: General Construction Co., Bridgeport, Conn., $13,400 (awarded contract on residuum).

Repair Contract No. 77, Loon Lake-Pottersville-Taylors County Highway No. 692, Warren County: Santanoni Construction Co., Albany, N. Y., $31,505 (awarded contract on Bermudez).

Repair Contract No. 74, Granville-Troy Stage County Highway No. 104, Washington County: R. Hopkins, Troy, N. Y., $7,435 (awarded contract on residuum).

Repair Contract No. 69, Echo-Lake Pines Bridge County Highway No. 143, Pines Bridge-Yorktown Heights County Highway No. 148, Westchester County: Yorktown Heights-Putnam County Line County Highway No. 149: All bids rejected.

Repair Contract No. 70, White Plains Cross Road County Highway No. 20, White Plains-Armonk County Highway No. 35, Westchester County; Armonk-Mt. Kisco County Highway No. 50: H. B. Sproul, Peekskill, N. Y., $55,890 (awarded contract on residuum).

Repair Contract No. 71, Mt. Kisco-Bedford County Highway No. 51, Bedford-Cross River County Highway No. 144, Westchester County; Cross River-Turk Mill County Highway No. 150: H. B. Sproul, Peekskill, N. Y., $66,690 (awarded contract on residuum).

S. Percy Hooker, chm. com., 53 Lancaster st., Albany, N. Y.

SEWERS.

CONTEMPLATED WORK.

Cresco, Ia.—New bids for sewer construction will be asked.

Oshkosh, Wis.—Plans for a sewer in Minnesota st. have been prepared.

Bushnell, Ill.—The installation of a sanitary sewer is contemplated.

Monroe City, Mo.—Plans for constructing sewers are being prepared.

Prosser, Wash.—Plans for constructing a sewerage system have been adopted.

Kenosha, Wis.—Council has adopted plans for a trunk sewer, 2 mis. in length.

Ellisville, Miss.—The construction of a sewerage system is contemplated. Mayor.

Madison, S. D.—Will vote on the issue of $100,000 for installing a sewer system.

Biwabik, Minn.—The village engineer will prepare plans for sewer construction.

Pensacola, Fla.—This city voted, June 14, to issue $100,000 bonds for additional sewerage.

Lake Charles, La.—Will vote July 14 on the issue of $160,000 for installing a sewerage system.

Sioux Falls, S. D.—The construction of a complete sewerage system is contemplated.

St. Cloud, Minn.—S. S. Chute, cy. engr., will prepare plans for a sewer on the east side.

Savannah, Ga.—J. N. Howard, cy. engr., estimates the cost of house drainage extensions at $382,919.

Topeka, Kan.—Engr. Fullin is preparing plans for the construction of a drainage system in North Topeka.

Hutchinson, Kan.—An ordinance has been adopted for constructing 6 additional sewers and sewer extensions.

Medicine Hat, Alta.—This city contemplates the construction of terra cotta sewers. H. K. Gimmer, cy. engr.

Chatham, N. J.—The construction of a sewage disposal plant here for the use of this city and Madison is contemplated.

East Aurora, N. Y.—Special.—A. Brotherhood, vil. prest., desires information regarding apparatus for pumping out cesspools.

New Bedford, Mass.—The city council has appropriated $50,000 for constructing the intercepting sewer. Wm. F. Williams, cy. engr.

Mt. Vernon, Ia.—Special.—This city contemplates the construction of a sewerage system and disposal plant. E. T. Gruwell, mayor.

Bakersfield, Cal.—The construction of vitrified pipe sewers in E, O, P, Q, R and S sts. is contemplated. A. L. Lightner, cy. clk.

Indianola, Ia.—Council will take action July 25 on the proposed sewer construction.

Winnemucca, Nev.—L. C. Kelsey, of Salt Lake City, has been engaged as consulting engineer of the proposed sewerage system.

Hutchinson, Kan.—An ordinance has been adopted for constructing a system of drainage in the eastern part of this city.

Los Angeles, Cal.—An ordinance has been passed to construct a concrete and brick storm sewer in Alameda and adjacent streets.

Peoria, Ill.—Plans for two sewer systems, one in the north and one in the south end of this city, are being prepared by Clay Belsley, cy. engr.

Silvis, Ill.—Surveys are being made for the construction of 3 mis. of vitrified tile storm sewer. Wallace Treichler, cons. engr., Rock Island.

Janesville, Wis.—A hearing will be held July 11 before Judge Germin in circuit court, regarding the organization of a drainage district in the town of Lima.

Windsor, Mo.—The city council will call a special election in the near future to vote on the issue of bonds for constructing a sewer and water-works system.

Leonia, N. J.—The South Side Sewer Co. has been incorporated by Benjamin H. Belknap, Edward Grinslade and Arthur D. Bovert, to operate plants for sewerage or drainage purposes.

Johnstown, N. Y.—The State health board has granted this city permission to construct a trunk line sewer along Cayadutta creek, from N. Market to Montgomery sts., provided the city file with the State board of health plans for a sewage disposal plant on or before June 1, 1911. Cy. engr. Campbell.

Pasadena, Cal.—S. T. Van Orm, cy. engr., has recommended the construction of sewers in California, Hill, Holliston, Chester, San Pasqual, Division and other streets. Plans have been adopted for a storm water sewer, consisting of a concrete open conduit, 1500 ft. in length, and the remainder to be reinforced concrete conduit. Herman Dyer, cy. clk.

Glen Cove, L. I., N. Y.—Special.—A report recommending the construction of 18 miles of 12 to 8-in. vit. pipe sewers and disposal by fine screening and discharge into twenty-one feet depth of water in Hempstead Bay at a total cost of $80,500 has just been presented to the Village Improvement Association of Glen Cove by W. B. Fuller, consulting engineer, 150 Nassau st., New York City. Mr. Fuller also recommends the parking of Glen Brook as a sanitary measure.

CONTRACTS TO BE LET.

Tracy, Minn.—Bids are asked until July 7 for constructing sewers. L. J. Fitch, cy. recdr.

Anderson, Ind.—Bids are asked until July 9 for constructing a ditch. Brice Dille, drainage comr.

Sabetha, Kan.—Bids are asked until July 12 for constructing sanitary sewers and 2 separate disposal works.

Plainfield, N. J.—Bids are asked until July 5 for constructing a storm sewer. A. J. Garett, cy. surv.

Le Mars, Ia.—Bids are asked until July 5 for constructing 863 ft. of 8-in. sewer. D. L. Struble, cy. clk.

Des Moines, Ia.—Bids are asked until July 6 for constructing sewers in a number of streets. J. R. Hanna, engr.

Omaha, Neb.—Bids are asked until July 5 for constructing sewers in certain districts. Dan B. Butler, cy. clk.

Appleton, Wis.—Bids are asked until July 6 for constructing sewers in various sts. W. L. Williams, cy. clk.

Eagle Grove, Ia.—Bids will be received about July 11 for constructing pipe sewers. Samuel Middleton, cy. clk.

Iowa Falls, Ia.—Bids are asked until July 6 for constructing a sewer system in dist. No. 11. J. O. Gregg, clk.

Grand Forks, N. D.—Bids are asked until July 5 for constructing a lateral sewer of clay pipe. Chas. J. Evanson, cy. audt.

East Chicago, Ind.—Bids are asked until July 20 for constructing 1800 ft. of sewer in 151st ave. R. K. Wallace, cy. engr.

Davenport, Ia.—Bids are asked until July 5 for constructing sewers in Telegraph st. and Summit ave. A. M. Compton, cy. engr.

Swift Current, Sask.—Bids are asked until July 12 for furnishing a large quantity of vitrified tile pipe. A. W. Snider, mayor.

Mason City, Ia.—Bids are asked until July 5 for constructing a lateral sewer in E. Howard st. J. H. McEwen, cy. clk.

South Bend, Ind.—Bids are asked until July 6 for constructing a pipe sewer in Milton ave. Otto C. Bastian, chm. B. P. W.

Davenport, Ia.—Bids are asked until July 6 for constructing a vitrified tile sewer in Christy st. A. M. Compton, cy. engr.

Carterville, Mo.—Bids are asked until July 7 for constructing a sanitary sewer in sewer dist. No. 2. F. A. Funk, cy. engr.

Plainfield, N. J.—Bids are asked until July 5 for constructing storm sewers. A. J. Cavett, cy. surv.; Jas. T. MacMurray, cy. clk.

St. Paul, Minn.—Bids are asked until July 5 for constructing a sewer in Capitol Heights and Gates st. R. L. Gorman, clk. B. P. W.

Sand Point, Idaho.—Bids are asked until July 11 for constructing a sewer system in 1st district. Dr. R. N. Jackson, chm. sewer com.

Oklahoma City, Okla.—Bids are asked until July 5 for constructing a lateral sewer in certain streets and blocks. Bob Parman, cy. clk.

Struthers, O.—Bids are asked until July 6 for constructing sanitary and storm water sewers in Short and Elm sts. L. S. Creed, vil. clk.

Balton, Tex.—Bids are asked until July 5 for constructing a system of sanitary sewers and a sewage purification plant. Chas. B. Smith.

Ft. Warren, Boston Harbor, Mass.—Bids are asked until July 7 for changes and extension of sewer system. Capt. A. M. Miller, constr. Q. M.

Cleveland, Miss.—Bids are asked until July 5 for the improvement of the channel of the Bayou Phalia. Wm. Connell, chm. bd. drainage comrs.

Savannah, Ga.—Bids are asked until July 25 for constructing a reinforced concrete drain in De Renne Canal. G. Reuben Butler, chr. co. comrs.

Harvard, Ill.—Bids are asked until July 5 for constructing ½ mi. of 12, 20, and 24-in. tile sewers. Hugh M. Price, cons. engr., 140 Dearborn st., Chicago.

Hugo, Okla.—Bids are asked until July 5 for constructing a sanitary sewer system, disposal plant, and all appurtenances. H. C. Blanchard, cy. engr.

Jacksonville, Fla.—Bids are asked until July 5 for constructing terra cotta and brick sewers. W. M. Bostwick, Jr., chm. w. w. trustees.

Winona, Minn.—Bids are asked until July 11 for constructing a storm water and sanitary sewer in 3rd and Liberty sts. Paul A. Jasmer, cy. recdr.

Attleboro, Mass.—Bids are asked until July 6 for constructing a trunk sewer and filtration areas, in 7 contracts. Chas. S. Holden, M. D., chm. comm. on sewerage.

Champaign, Ill.—Bids are asked until July 2 for constructing main open ditch in sub-districts No. 1, 2, 3, and 4. Alvah James, comr. special drainage dist., Mansfield, Ill.

Missoula, Mont.—Bids are asked until July 11 for constructing sanitary sewers in certain special improvement districts. C. W. Swearingen, cy. engr.; W. A. Logan, cy. clk.

Boston, Mass.—Bids are asked until July 9 for constructing a drain at the Navy Yard, Boston. R. C. Hollyday, ch. Bureau Yds. & Docks, Navy Dept., Washington, D. C.

Pella, Ia.—Bids are asked until July 6 for constructing 6 mis. of 8 to 15-in. pipe sewer and disposal plant. A. C. Kuyfer, cy. clk.; Iowa Engrg. Co., cons. engr., Clinton, Ia.

Leon, Ia.—Bids are asked until July 12 for constructing 2 mis. 6 to 12-in. pipe sewer and disposal plant. S. G. Mitchell, cy. clk.; Iowa Engrg. Co., cons. engrs., Clinton.

New York City.—Bids are asked until July 6 for constructing sewer in various sts. in Queens boro. Lawrence Gusser, prest. boro. Bids are asked until July 6 for constructing sewers in Brooklyn boro. Alfred E. Steers, prest. Brooklyn boro.

Charleston, S. C.—Bids are asked until July 11 for constructing a sewerage receiving tank, pump pit and appurtenances, including vertical centrifugal pumps and electric motors, with controlling devices. Bd. sewer comrs.

Morristown, Pa.—Bids are asked until July 8 for constructing a sewage disposal plant, laying c. i. and terra cotta pipe, constructing, collecting wells and pump houses, and furnishing machinery, for State Hospital for Insane. Frank L. Smith, treas.

Munising, Mich.—Bids are asked until July 7 for constructing 6834 ft. of 8 to 24-in. vitrified pipe; 1985 ft. 2 ft. by 3 ft., and 3 ft. by 3 ft. 6 in. concrete sewers; 2 bulkheads, 19 manholes, 19 catchbasins, 1 lamphole, 700 sewer catchbasin covers. Jas. Tracy, cy. clk.; W. G. Kirchoffer, cons. engr., Madison, Wis.

CONTRACTS AWARDED.

Evansville, Ind.—G. L. Hughes was awarded the contract, June 14, for building sewers.

Lincoln, Neb.—H. C. Gardner was awarded a contract for constructing the sewer and water works systems, for $13,489.

Frederick, Md.—Coblentz & Klipp secured the contract for constructing a sewer in Carroll and N. Market sts.

Sioux City, Ia.—Christenson & Co. was awarded the contract for constructing a storm sewer in Prospect st.

Depew, N. Y.—Anthony Hartung secured the contract for extending the sewer system on the south side, for about $35,000.

Havelock, Neb.—H. C. Gardner, of Lincoln, was awarded the contract, June 7, for the construction of a sewer system, for $13,849.

Baldwin, Kan.—The contract for constructing a sewer system was awarded

to the Squire Electric & Construction Co. of Kansas City, Mo.

North Andover, Mass.—Arthur A. O'Mahoney was awarded the contract for constructing 6300 lin. ft. of pipe sewers.

Marseilles, Ill.—Greens Sons Co. was awarded the contract for constructing a sewer for $26,744.

Ft. Sill, Okla.—The lowest bid submitted for constructing the sewage purification plant was that of Luyster & Lowe, of Dayton, O., which was $12,600.

San Francisco, Cal.—The Healy-Tibbitts Construction Co. secured the contract for constructing section A of the North Point Main sewer, for $164,300.

Syracuse, N. Y.—Albert Gafney was awarded a contract for constructing a sewerage system in Stinard and Gordon aves. and Giddes st., for $1,863.30.

Ann Arbor, Mich.—Contracts for constructing sewers have been awarded as follows: Koch Bros., dists. Nos. 41, 36, 37 and 40. E. L. Schneider, 2 sewers.

Westfield, Mo.—The contract for constructing 4100 ft. of pipe sewers was awarded, June 11, to Edward B. Roberts, 730 Old South Bldg., Boston, for $4.770.

Council Bluffs, Ia.—The contract for the excavation of Pigeon creek ditch was awarded to C. H. Stemberg & Sons, of Chicago, at 5.4 cts. a cu. yd. The work involves 788,000 cu. yds. of earth.

Tacoma, Wash.—Contracts for constructing sewers were awarded, June 7, as follows: Monroe st. storm sewer, L. Y. Stayton, $22,000; sanitary sewer in dist. No. 194, Tiguanelli & Paine, $4,900.

Macon, Ga.—The contract for constructing a new auxiliary system of sewers in Vineville, Horth Highlands, and newly annexed parts of the city was awarded, June 6, to R. S. Clemons & Co., for $5,632.18.

Portland, Ore.—The contract for constructing the Powell st. sewer system, in the Brooklyn dist., was awarded to Bechill Bros., for $19,576, and the E. 8th, E. 9th and E. 10th sts. systems to Wm. Lind, for $18,683.

Salt Lake City, Utah.—Special.—Contracts for sewer extensions were awarded, June 23, as follows: Sewer exten. No. 246, D. L. Pitt, $945.54; No. 267, J. D. Hanley, $698.25; No. 251, A. A. Clark, $34,475.22. G. F. McGonagle, cy. engr.

Newark, N. J.—Sewer contracts have been awarded as follows: Building sewers in Avenue A, Frelinghuysen ave. and Dayton st., Jas. A. Christie, $22,524.95; Park ave., Pasquali Maurillo, $1,548.40.

Boston, Mass.—Sewer contracts have been awarded as follows. Gainsborough st., McCarthy & Walsh, of East Boston, $5,181; Rosindale branch of Stony Brook conduit, Charles R. Gow & Co., 79 Milk st., $40,870; sec. 7 of Stony Brook conduit, Wm. J. Barry, 30 Fenwood road, Rexbury, $75,320.

Creston, Ia.—Special.—George W. Auracher was awarded a contract for constructing 1400 ft. of 6-in. sewer at 72½ cts. a lin. ft.; 1800 ft. 8-in. sewer at 95 cts.; 6-in. specials, 35 cts. each; 8-in. specials, 40 cts. each; manholes, 30-in. clear, 4-in. vitrified brick walls and 4-in. concrete bottom, no tops, $3.40 a ft.

Hubbell, Mich.—The contract for constructing sewers was awarded to the Pearce Hardware & Furniture Co., of Lake Minden, Mich., as follows: $1.87 per ft. for 300 ft. of 30-in. sewer tile; at 14 cts. per ft. for 100 ft. of 8-in. sewer tile; at $14 for one 30x30 Y; at $14 for one 30x30x20 Y, and at $7.48 for one 30x18 reducer.

New Hampton, Ia.—The contract for sewer construction was awarded to Fraser & Danforth, of Rochester, Minn., as follows: 55 cts, per ft. for the construction of 4,000 ft. of 8-in. sewer, and at 48½ cts. per ft. for the construction of 3,000 ft. of 4-in. water mains. The work includes manholes, flush tanks, hydrants and valves.

St. Louis, Mo.—Bids for constructing the first section of the Glaise Creek and River des Peres sewers were submitted, June 14, as follows: George G. Pendergast Construction Co., $161,392; Southern Construction Co., $165,785; Hoffman-Hogan Construction Co., $171,818; John F. McMahon, $179,696; Fruin-Colnon Construction Co., $182,427. The estimated cost of the sewer is $180,000. On the River des Peres work the bidders and amounts were: Southern Construction Co., $310,533; Scott-Harmon & Hickey, $375,270; American Engineering Co., $385,462. The estimate is $324,000.

WATER WORKS.

CONTEMPLATED WORK.

Worland, Wyo.—The construction of a water works system is contemplated.

Joseph, Ore.—A new municipal water works system will be built this summer.

Francis, Ore.—A water works system is contemplated.

Wyandotte, Mich.—The extension of the water works system is contemplated.

Wellington, Kan.—A water works system is contemplated.

Blytheville, Ark.—A water works system is contemplated.

Meridian, Idaho.—A water works system is proposed.

Lonsdale, Tenn.—A water works system is contemplated.

Liberty, Mo.—Voted to issue $20,000 for water works bonds.

Herrin, Ill.—The construction of a reservoir is contemplated.

Carson, Ia.—Will vote on the issue of $15,000 water works bonds.

Greenfield, Mass.—Voted to build a reservoir on Rucky Mountain.

Carson, Ia.—Will vote on the issue of bonds for a water works system.

Cleveland, Miss.—A water works system is contemplated. I. A. Kamden, town clk.

Grand Forks, N. D.—A filter and intake is contemplated. H. C. Lykken, cy. engr.

Conway, Ark.—Estimates have been completed for constructing a water works plant.

Canton, Kan.—Voted to issue bonds for installing water works and electric lights.

Amherst, O.—Bids will be asked for soon for constructing a water works system.

Clifton Heights, Pa.—Will vote on the issue of bonds for a water works system.

Kendrick, Idaho.—Will vote, July 10, on the issue of $10,000 bonds for water works.

Beecher, Ill.—An air pressure water works system will be installed. R. J. Ban, atty.

Atlanta, Ga.—The town of Kirkwood has asked this city to furnish it with water.

Lawton, Okla.—Bids will be asked for constructing a water works system in Gore addition.

Eureka Springs, Ark.—About $50,000 will be expended in improving the water works.

Petersburg, Va.—This city has appropriated $9,000 for an addition to the filter plant.

El Reno, Okla.—Bids will be asked soon for constructing a municipal water works plant.

Malden, Mo.—Bids will be asked for soon for constructing a water works and power plant.

East Alton, Ill.—The question of establishing a municipal water plant will be voted on.

Windsor, Mo.—This city will issue bonds for the construction of a water works system.

Pittsburg, Kan.—This city will vote on the issue of bonds for constructing a water works plant.

Glasgow, N. S.—Preliminary surveys are being made for a water works system. Jas. Ray, town clk.

Kaw City, Okla.—This city will vote on the issue of bonds for constructing a municipal water works system.

Douglas, Ga.—The improvement of the water works system is contemplated. R. W. Peatross, cy. engr.

Kingsley, Ia.—This city voted to install water works, and bids will be asked for their construction.

Norfolk, Va.—This city will appropriate $17,000 for extensions of the water mains in the 7th ward.

Connersville, Ind.—Plans for an improved water works system will be prepared by engineer Marvin.

Toulen, Ill.—An ordinance has been passed providing for the establishment of a municipal water works system.

Aransas Pass, Tex.—This city will vote on the issue of bonds for installing a municipal water works system.

Limon, Colo.—Plans are being prepared for constructing a water works and electris light plant.

Shiner, Tex.—The question of issuing bonds for the extension of the water works system will be voted on.

Binghamton, N. Y.—Bids may be asked in September for constructing a reservoir on Mt. Prospect at Mygatt st.

Abbeville, Ala.—This city will vote, July 19, on the issue of bonds for installing a water works system.

Beatrice, Neb.—The city voted to issue $70,000 bonds for water works extension and a municipal light plant.

Collins, Miss.—Bids will be received soon for constructing a concrete underground or a steel overground reservoir.

Columbia, S. C.—The construction of a 9-inch water main in Huyer st. to supply water to Glencoe Mills is contemplated.

Naples, Tex.—Hon. B. R. Watts has applied for a franchise to erect an electric light plant and water works system.

St. Augustine, Fla.—A committee has been appointed to consider the installation of modern machinery in the water works plant.

Pittsburg, Pa.—Mayor Magee has signed an ordinance providing for the extension of the city filtration plant at Aspinwall.

St. Petersburg, Fla.—Will vote July 19 on the issue of bonds for the improvement and extension of the water works system.

Atlanta, Ga.—College Park voted to issue $65,000 bonds for constructing water works, sewerage and electric light systems.

Woodland, Cal.—The board of trustees have decided to investigate the question of securing a pumping and auxiliary pumping plant.

Tabor, Ia.—The citizens have asked that a special election be called to vote on a bond issue for an improved or new water supply.

Kearney, Neb.—This city voted to purchase the water works plant at the figures offered by the American Water Company, $125,000.

New Bethlehem, Pa.—Special)—S. C. Hilliard, supt. Citizens' Water Co., says they expect to install an additional gas engine pumping unit soon.

St. Augustine, Fla.—Mayor Masters is a member of a committee appointed to consider the question of installing modern machinery in the water works.

Safford, Ariz.—This city contemplates piping water from Graham mountain, a distance of 8 miles. Reservoirs and dams will also be constructed.

Bristol, Pa.—The borough council has approved the engineer's plans and detailed drawings for a complete municipal water works system and filtration plant.

Baltimore, Md.—New specifications have been approved and bids will be asked for soon for constructing a pumping station for the high-pressure pipe line.

Bucyrus, O.—The committee on extension of water mains has reported favorably on the extension of water mains on Gallon, Plymouth and E. Mansfield sts. and Faustina ave.

Plainfield, N. J.—The advisability of purchasing, constructing or condemning the water works plant will be investigated by Jas. H. Fuertes, 140 Nassau st., New York City.

Weston, Ore.—Extensive repairs are contemplated for the water works system, and the water committee has been empowered to purchase piping, gates and hydrants.

Rossville, Ill.—Owing to the inadequacy of the water works system, the water board has begun the formulation of plans for the removal of the old plant and the constructiin of a new one.

Indianapolis, Ind.—The Indianapolis Water Co. has made a proposition to the Board of Public Works, offering to rent the Brightwood water works plant, which has been taken under consideration.

Harrisburg, Pa.—Application has been made by this city to the State Water Comm. for permission to construct a dam across the river at the lower end of this city. M. B. Cowden, cy. engr.

Charleston, S. C.—The city council decided, June 14, that the Charleston Light and Water Co. had failed to comply with the requirements of the contract and refused to grant the franchise.

Eveleth, Minn.—The city engineer has been directed to prepare plans and specifications for installing 4,000 ft. of 16-in. c. i. water pipe from the Foyal location to the water works system.

Winnifield, La.—The water works comm. have appointed a committee of two to confer with Mayor Cooper regarding the making of a map and in determining in what streets additional water mains shall be laid.

Batavia, N. Y.—(Special)—Plans and specifications have been prepared and bids will be received about July 20 for constructing a concrete dam of about 500 cu. yds. Fred New, vil. clk.; Russell A. Wentworth, cy. engr.

South Bend, Ind.—The water works system will be entirely rebuilt this year at an estimated cost of $50,000. An electris power pumping station will be erected in Leefer Park and will take the place of both the north and central stations of the present system, and the old plants will be dismantled and abandoned.

Salem, Ore.—A report has been submitted by J. T. Whistler, cons. engr., of Portland, on furnishing this city with a new water supply. He recommends the Little North Fork of the Santiam river, providing for a filtered system of 10,000,000 gals. per day, at a cost of $1,430,000;

or, an unfiltered system from the Breintenbush river, of 15,000,000 gals. per day, at a cost of $1,780,000; or, a filtered system from the Willamette river, of 16,000,000 gals. per day, at a cost of $1,240,000.

CONTRACTS TO BE LET.

Louisa Va.—Bids are asked until July 2 for boring an artesian well. J. J. Porter.

Chisholm, Minn.—Bids are asked until July 6 for constructing a 300,000-gal. storage tank.

Cando, N. D.—Bids are asked until July 11 for digging a well. H. D. Skinner, cy. audt.

Albion, Pa.—Bids are asked until July 5 for constructing a water works system. S. A. Collins, town clk.

Ft. Smith, Ark.—Bids are asked until July 6 for extension of the water mains. Bd. public affairs.

New York City.—Bids are asked until July 6 for 5 portable meters. Henry S. Thompson, comr. water sup., etc.

Waynesboro, Va.—Bids are asked until July 8 for constructing a steel standpipe. P. D. Woodine, town prest.

Mountain Lake, Minn.—Bids are asked until July 2 for the extension of the water works system. J. H. Dickman, clk.

Mason City, Ia.—Bids are asked until July 5 for drilling 1, with the privilege of 2 or 3, 10-in. wells. Cy. clk.

Salt Lake City, Utah.—Bids are asked until July 8 for sinking an artesian well on Levan Ridge. W. H. Farnsworth, sec. land bd.

Boulder, Colo.—Bids are asked until July 18 for constructing a rubble concrete masonry dam at Albion Lake reservoir. Cy. Coun.

Corydon, Ia.—Bids are asked until July 11 for drilling a deep well. J. J. C. Bower, cy. clk.; Iowa Engrg. Co., cons. engrs., Clinton.

Union City, Mich.—Bids are asked until July 11 for constructing seven 6-in. tubular wells at the water works station. Adelbert Thum, vil. clk.

Grand Rapids, Mich.—Bids are asked until July 7 for constructing a clear water conduit, intake and drain. Henry J. Klevorn, pres. B. P. W.

Spooner, Wis.—Bids are asked until July 5 for laying 5,500 ft. of 4-in. water main and furnishing 4 hydrants. Geo. B. Sage, cy. clk.

Muskogee, Okla.—Bids are asked until July 5 for furnishing 16,130 ft. 6-in. c. i. pipe, fire hydrants, etc. Chas. Wheeler, Jr., cy. clk.

New York City.—Bids are asked until July 6 for constructing water mains in Mosholu Parkway, Jerome ave., etc. Henry S. Thompson, comr. water sup.

Viroqua, Wis.—Bids are asked until July 7 for constructing a pump house. Cy. clk.

Faulkton, S. D.—(Special)—A. Boller, w. w. comr., says this city is in the market for one triplex pump of 450 gals. per minute, and 8 and 4-in. c. i. pipe.

Denver, Colo.—Bids are asked until July 2 for constructing a storage reservoir at Santa Maria Lake. Frank C. Goudy, pres. Rio Grande Reservoir and Ditch Co.

Ft. Mason (San Francisco P. O.), Cal.—Bids are asked until July 5 for constructing an 8-in. water main from Presidio of San Francisco to Ft. Mason. Major Geo. McK. Williamson, Q. M.

CONTRACTS AWARDED.

Center, Tex.—The contract for the extension of the water works system was awarded to H. C. Barrow.

Duluth, Minn.—Johnson & Johnson secured the contract for 25 sections for 12,298 ft. of water and gas main extensions.

Waterbury, Conn.—The contract for constructing the Morris reservoir was awarded to Ryan & Unmack, of New Haven, for $528,463.

Dows, Ia.—The contract for the extension of the water works system was awarded to the Des Moines Bridge and Iron Co., of Des Moines.

Attleboro, Mass.—The contract for constructing a new reservoir was awarded, June 10, to Bruno & Petitte, 18 Tremont st., Boston, for $48,460.

Nashville, Tenn.—The contract for the purchase of 215 ⅝-in. water meters was awarded to the National Meter Co. at $10 each for the meters.

Galveston, Tex.—The contract for furnishing c. i. water pipe and fittings was awarded, June 9, to the American C. I. Pipe Co., of Birmingham, for $2,000.

Englewood, Kas.—The contract for engineering work in connection with the proposed water works system was awarded to the J. S. Worley Co., of Kansas City, Mo.

Batesville, Ind.—The contract for the extension of the water mains was awarded, June 6, to the Bourbon Copper and Brass Works, of Cincinnati, for $3,130.

Essexville, Mich.—Peter Peterson, of Bay City, has been awarded the contract for the excavation and laying of water pipes for the new water works system.

Fairfax, Okla.—The contract for constructing a water works and sewerage systems was awarded to the Southwestern Engineering Co., of Oklahoma City, for $50,000.

Raymond, Mich. — The contract for erecting a tower and tank and constructing 2,000 ft. of mains was awarded to the Des Moines Bridge and Iron Co., of Des Moines, Ia., for $5,488.

Tyrone, Pa.—The Vipond Construction Co., of Altoona, Pa., was awarded, June 10, the contract for constructing a storage reservoir and for an addition to the present reservoir.

Jacksonville, Ill.—The contract for constructing the water ppe to connect the city mains with the Widenham-Daub wells was awarded to the Jacksonville Plumbing and Heating Co.

Hammond, Ind.—The Calumet Construction Co., 234 LaSalle st., Chicago, was awarded the contract, June 15, for the extension of the water supply intake in Lake Michigan, for $47,140.

New Baden, Ill.—Contracts have been awarded as follows: Tank and tower, Fred J. Koch; laying 2,700 ft. 8-in., 1,900 ft. 6-in. and 150 ft. 4-in. pipe, at 84, 62 and 45 cts. a ft., respectively, J. A. Hartman, of Olney, Ill.

Seattle, Wash.—Contracts for constructing water mains have been awarded as follows: West 59th st. and other streets, water mains, to Allain & Hull, at $9,878; Klickitat ave. and other streets, water mains, to Will Kopta, at $15,182; West 63d st., sewer, to G. Savistio, at $4,234; California ave. and other streets, sewer, to Allain & Hull, at $18,915; North 51st st., water mains, to Jahn Construction Co., at $39,865.

Duluth, Minn.—Contracts for water and gas main extensions have been awarded as follows: Johnson & Johnson, 6,892 feet for $5,208; Pastoret & Lawrence Co., 2,316 feet for $1,802; Kern & Nickerson, 2,472 feet for $2,621; Fairbanks, Morse & Co., 408 feet for $288; Erick Nordquist & Co., 372 feet for $1,741, and McAdams, Preston & Co., 468 feet for $373.

BRIDGES.

Bluffton, Ind.—Bids are asked until July 8 for constructing 7 bridges. O. D. Garrett, co. audt.

Pierre, S. D.—Bids are asked until July 5 for building various bridges. C. M. Price, co. audt.

Lebanon, Ind.—Bids are asked until July 8 for constructing 7 bridges. B. F. Herdrich, co. audt.

Hartford City, Ind.—Bids are asked until July 5 for building 5 culverts. L. W. Daugherty, co. audt.

Quebec, Que.—Bids will be received until Sept. 1 for constructing the Quebec bridge.

Solon, Me.—A new bridge across the Kennebec river, at Aubden and Solon, is contemplated.

Mt. Gilead, O.—Bids are asked until July 7 for constructing a steel bridge. Clifton Sipe, co. audt.

Cleveland, O.—Bids are asked until July 13 for constructing bridge work. F. R. Lander, co. surveyor.

Frankling, Pa.—Bids are asked until July 7 for building Petroleum bridge at Oil City. A. C. Lewes, co. audt.

Arcadia, Tex.—Bids are asked until July 5 for building 50 to 100 wooden bridges. R. W. Luttrell, engr. drain dist.

Lawrenceburg, Ind.—Bids are asked until July 5 for constructing a bridge over Hogan creek. W. L. Fagaly, co. audt.

Crown Point, Ind.—Bids are asked until July 5 for constructing a bridge in Ross twp. C. A. Johnson, co. audt.

Shelbyville, Ind.—Bids are asked until July 6 for the repair of Custinger bridge. G. B. Huntington, co. audt.

Ft. Benton, Mont.—Bids are asked until July 11 for constructing a combination or steel bridge. W. R. Leet, co. clk.

Fargo, N. D.—Bids are asked until July 6 for constructing and repairing bridges. Arthur G. Lewis, co. audt.

Ottawa, Can.—Bids are asked until July 4 for constructing a bridge across the Saskatchewan river at Pas Mission.

Omaha, Neb.—Bids are asked until July 30 for constructing bridges during the next year. D. M. Haverly, co. clk.

Greenfield, Ind.—Bids are asked until July 5 for constructing 3 concrete and steel bridges. C. H. Troy, co. audt.

Martinsville, Ind.—Bids are asked until July 5 for constructing a bridge in Gregg twp. B. E. Thornburgh, co. audt.

Syracuse, N. Y.—The National Construction Co. has been awarded a contract for a steel plate girder bridge for $37,057.

Binghamton, N. Y.—Bids are asked until July 11 for the reconstruction of a river bridge over Chenango river. Co. comrs.

Jeffersonville, Ind.—Bids are asked until July 16 for constructing a bridge over Logan creek. Peter Machaud, co. audt.

Danville, Ill.—Bids are asked until July 5 for constructing a reinforced concrete bridge of 3 arches. F. Payne, town engr.

Albion, Ind.—Bids are asked until July 5 for constructing and repairing bridges, culverts and abutments. John W. Earle, co. audt.

Bloomington, Ill.—Plans are being formulated for constructing new crossings over the Chicago & Alton tracks. R. L. Carlock, engr.

Peru, Ind.—Bids are asked until July 6 for the repair of Eel river bridge, in the town of Mexico. Chas. Griswold, co. audt.

Visalia, Cal.—Bids are asked until July 12 for constructing a reinforced concrete conduit and bridges. Marve L. Weaver, cy. engr.

Pocatello, Idaho.—Bids are asked until July 17 for constructing a steel bridge across Bear river at Soda Springs. Bd. co. comrs.

Frankfort, Ind.—Bids are asked until July 6 for the repair of 20 bridges and constructing one new bridge. C. F. Cromwell, co. audt.

Alexandria, La.—Bids are asked until July 28 for building creosoted timber frame protection, fender on piles. Ira W. Sylvester, co. engr.

Greenville, Miss.—Bids are asked until July 4 for constructing a steel bridge across Bayou Phalia, at Ingram. W. W. Miller, clk. bd. supvrs.

Cincinnati, O.—Bids are asked until July 8 for constructing a concrete bridge in Harris ave., Mt. Washington and Anderson twps. Fred Dreihs, ch. co. comrs.

West Point, Miss.—Bids are asked until July 5 for constructing a trestle about 200 ft. long on the west side of Houlka drainage canal. L. J. Howard, co. clk.

Columbus, Ga.—Bids are asked until July 18 for constructing a concrete steel arch bridge over the Chattahoochee river at Dillingham st. W. A. Campbell, supt. pub. wks.

Wilmington, Del. — The contract for building a concrete bridge at Moxentown mill dam, in St. George's Hundred, was awarded to H. M. Lockwood, of Middletown, for $3,160.

Philadelphia, Pa.—The contract for a highway bridge on the line of Fox st., over P. G. & N. R. R., has been awarded to Richard Walsh, 5922 Tacony st., for $35,479.

Jamestown, N. Y.—The contract for constructing concrete bridges over the Chadakoni river, at Fairmount ave. and Winsor st., was awarded to Mahoney & Sevanson, for $50,000.

Columbus, O.—Bids are asked until July 14 for constructing the substructure roadway approaches of the Grant river bridge on Jackson Pike, in Jackson twp. Co. comrs.

Sandusky, O.—Bids are asked until July 9 for constructing a highway bascule bridge over Huron river at Van Rensselear st. crossing in Huron, O. John Deist, co. audt.

Los Angeles, Cal.—Bids are asked until July 5 for constructing a concrete culvert across Walnut st. on Valley Center ave. in Glendora and San Jose roads districts. C. G. Keyes, co. clk.

Leesburg, Va.—Bids are asked until July 25 for constructing reinforced concrete or iron bridge across "The Dutchman," and for a bridge over Little river. J. J. Crim, ch. co. comrs.

San Luis Obispo, Cal.—Bids are asked until July 6 for constructing a steel concrete highway bridge over Saline river at Rictor crossing on the Santa Margarita and oPse road. H. H. Carpenter, clk. bd. supvrs.

Richmond, Ind.—Bids are asked until July 5 for constructing a concrete arch bridge and fills in Clay twp.; steel bridge in Franklin twp.; concrete pier bridge in Boston twp.; 2 concrete culverts and repair of 2 bridges. D. S. Cole, co. audt.

STREET LIGHTING.

Canton, Kas.—Voted to issue bonds for an electric light plant.

McKenzie, Tenn.—Voted to issue bonds for a street lighting system.

Francis, Okla.—Voted to issue bonds for installing an electric light plant.

Beatrice, Neb.—Voted to issue bonds for a municipal electric light plant.

Atlanta, Ga.—Voted to issue bonds for installing an electric light system.

Naples, Tex.—Hon. B. R. Watts has made application for an electric light franchise.

West Point, N. Y.—Bids are asked until July 6 for installing extension of steam distributing system. Q. M.

Centerville, Md.—The town bd. of comrs. is considering an application for a franchise to install a gas plant.

South Bend, Ind.—This city is considering plans for installing ornamental street lamps on some of the principal business streets.

Logansport, Ind.—The business men have decided to install an ornamental system of street lamps in Market, Third and Fourth sts.

Lafayette, Ga.—Plans and specifications for a municipal electric light plant will be made by J. D. McCrary & Co., of Atlanta.

Quincy, Ill.—An ordinance was introduced, June 20, providing for a franchise for a gas and electric light plant. The ordinance will come up for final reading, July 19.

Memphis, Tenn.—Bids are asked until July 5 for furnishing incandescent gas and gasoline lights, and equipment and maintenance of same. Ennis M. Douglas, cy. clk.

Sturgis, Mich.—Bids are asked until July 6 for constructing a brick and concrete water power station, excavating for a tail race, and constructing a concrete multiple arch spillway and an earth embankment. B. P. W.

PARKS.

Dover, N. H.—An acre of ground has been presented to this city by J. Belknap Guppey, for a small park.

Peoria, Ill.—The park bd. has purchased the Bemis house site for park purposes.

Akron, O.—The park board has asked for an appropriation of $20,000 for the purchase and improvement of 6 acres of land.

Oklahoma City, Okla.—A $400,000 bond issue has been decided upon for park purposes and for circling the city with a gravel boulevard.

Washington, D. C.—A bill was introduced, June 6, providing for the purchase of 4 squares of land in Pelworth addition for a public park.

Memphis, Tenn.—The park commissioners have provided a park for colored people, to be maintained on the same lines as the other public parks.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Natchez, Miss.—Bids are asked until August 3 for sprinkling streets. W. G. Benbrook, engr.

Hutchinson, Kas.—Bids are asked until July 8 for sprinkling Sixth ave. for 1 yr. Ed. Metz, cy. clk.

St. Joseph, Mo.—The installation of a garbage incinerator plant is contemplated by the bd. of health.

Toledo, O.—Fred C. Alber, of Cleveland, was awarded the contract, June 10, for the disposal of the city's garbage.

Vancouver, B. C.—The contract for the new refuse and garbage destructor was awarded to the Public Works Engineering Co., Beck Bldg., Portland, Ore., for $72,500.

Portland, Ore.—(Special)—The Public Works Engineering Co., Beck Bldg., advises us that it is in the market for about 75,000,000 fire brick; roof tiling; 2 sets wagon scales; 2 recorders; temperature testing apparatus; 1 150-ft. chimney; 2 150-h.p. water tube boilers; 4 blower fans; 4 engines; steel dumping cars for incinerator, at Vancouver, B. C. Fred O. Potter.

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Municipal Engineering

VOLUME XXXIX AUGUST, NINETEEN HUNDRED TEN NUMBER TWO

Town Scavenging and Refuse Disposal

By Hugh S. Watson, A. M. I. C. E., London, England

THE UTILIZATION OF RESIDUALS FROM REFUSE DESTRUCTORS.

SLAG Making at the Destructor Works of the Corporation of Kingston-on-Thames.—The clinker removed from the destructors is converted into paving slabs in the following manner. It is first ground up to the necessary size, and is then mixed in the proportions of 2½ bushels of granite chippings, 4½ bushels of screened clinker, and 2 bushels of Portland cement. The granite chippings and cement are gauged 4 to 1. The chippings and cement are first placed in the mold to a depth of one inch, and the mass is shaken about so as to cause the chippings to fall to the bottom, in order to give a good hard wearing surface. The rest of the mold is then filled with clinker and cement. One gauging, as given above, will make 32 feet super of 2-inch stone. The slabs are allowed to remain in the molds for one week, in order to set, at the end of which time they are taken out and stacked in the open for from three to six months to mature. The molds consist of wooden frames with a bottom of sheet zinc. Slabs of varying sizes are made, as also crossing blocks and gutter channels. By using granite chippings for the surface a very much more durable stone is produced, though, of course, the cost of production is increased. Mr. R. H. Clucas, the Borough Surveyor, estimates this to be from 2 shillings expense to 2 shillings 9 pence (60 to 66 cents) per square yard.

The Manufacture of Paving Blocks at the Destructor Works of the Royal Borough of Kensington.—At the destructor works of the Royal Borough of Kensington, an entirely new process has been adopted for the manufacture of paving blocks from the clinker residual and Trinidad Lake asphalt, with the addition of a small quantity of residuum petroleum. Experiments were made some years before the existing plant was put down. These were begun by Mr. W. Weaver, the late borough engineer of Kensington, and were continued by Mr. A. R. Finch, the present borough engineer. The clinker is removed from the furnaces in iron skips. It is fed while still hot into a grinding mill, having rollers over two tons in weight, by which it is broken up into fine particles. From the grinding mill the crushed clinker is conveyed by means of an elevator to a revolving steel dryer, on which it is heated to a temperature of 250 to 300 degrees F. The heated clinker then passes to the mixing mill, where the asphalt and residuum petroleum mixture is added. The asphalt is melted and maintained at a high temperature by the use of steam coils. When it has reached a suitable condition a small quantity of the residuum petroleum is added. The proportions used are 8 parts of clinker to 1 of asphalt by weight. When the clinker and asphalt have become thoroughly incorporated, the mixture is run into molds of the shape of an ordinary brick 9 inches by 4½ inches by 3 inches, and pressed in a machine which exerts a total pressure of approximately 90 tons on each block. From the pressing machine the blocks are passed into a cooling tank filled with water, through which they are carried on an endless conveyor. The blocks are black in color, and weigh about 9 lbs. each. They are laid after the manner of ordinary wood paving blocks, except that they are laid on their sides, instead of being placed on edge. They have been used on several streets under moderate traffic in the borough, and after upwards of two years trial are wearing well. The cost is stated to be about five shillings per square yard in place, but exact

figures as to cost are not available, owing to the plant still being for maintenance purposes in the hands of the constructors, Messrs. Goddard, Massy & Warner, of Nottingham.

Disposal of Flue Dust.—There are two methods, in common use, of disposing of the flue dust which is arrested in the dust catcher. The first of these is to mix it with some disinfectant and to employ it in disinfecting sanitary bins, or at the depots. The second is to use it as a fertilizer for grass or for lightening heavy soils. When used as a disinfecting powder the dust is usually mixed with carbolic acid in the proportions of 30 gallons of carbolic acid to every ton of dust.

Utilization of By-Products Recoverable from Refuse.—Having dealt with the utilization of the residuals from refuse destructors, there is still the question of the utilization of the by-products proceeding from the refuse itself to be considered. At most destructors the refuse is generally roughly screened before being put into the furnaces, and certain articles, such as bottles, tins and pieces of iron, etc., removed. The materials so recovered can be disposed of at a profit.

Tins and Scrap Iron.—There is a company known as the London Electron Works Co., Ltd., which purchases the tins recovered from the refuse of most of the Metropolitan Boroughs and towns within easy reach of London. This company treats the tins by an electro-chemical process to recover from them the solder and the pure tin. Briefly, the process is as follows: The tins are put into vats containing a chemical solution. An electric current is passed through the chemical and removes the whole of the solder and tin, which falls to the bottom of the vats, in the form of a thick sludge. The tins are then removed and pressed solid. The blocks thus made are despatched to iron or steel works for re-manufacture. The tin sludge is separated from the chemical solution and the solder removed. It is then partially dried and pressed into blocks which are sent to the tin smelting works for extraction. The prices realized at the different works vary very considerably. Thus, at the Metropolitan Borough of Fulham's works the tins and galvanized iron are sold together for 6 shillings and 7 pence per ton, while at Ealing tins alone realize 15 shillings per ton at the works; at Watford 16 shillings per ton on the rail, and at Kingston-on-Thames 17 shillings per ton. There is, of course, a certain amount of labor involved in separating the tins from the galvanized iron. Old iron fetches prices varying from one to five shillings per ton, the former price being paid at Ealing, and the latter at Kingston. The galvanized scrap collected at Watford is also disposed of at five shillings per ton.

When the tins have to be carted any considerable distance it will generally be found profitable to crush them, as by so doing a very much larger weight of tins can be loaded into a cart, railway truck or barge than would be possible if they retained their original bulk. Tin crushing machines are manufactured by Messrs. Joseph Adamson & Co. of Hyde, Cheshire, and Messrs. C. Whittaker & Co., Ltd. of Accrington. A point that should be noted is that the tins must not be crushed absolutely flat, as if this is done they are not so suitable for treatment for the recovery of the pure tin and solder, and consequently their value is depreciated. They should be flattened only to such an extent as to leave it possible for the chemicals used in the process of recovery to play all over their surfaces.

The Manufacture of Fish Manure.—In many towns a special plant is in use for dealing with fishmongers' refuse, which, if burned in the ordinary way in the destructors, creates a considerable nuisance on account of the smell, more especially as by the time it reaches the works it is rarely fresh. Fish refuse, if dried, makes a very good manure, containing about 10 per cent. of ammonia, and 20 per cent. of phosphate of lime. There is also a very good demand for it, its value being about 6 pounds 10 shillings ($31.50) per ton on the rail. The corporation of Blackpool has installed a plant which consists of an inner and outer cylindrical shell, tehinner one of which has radial arms, fixed to a center shaft driven by an electric motor. The fish refuse is fed into the inner shell and is broken up by the revolving arms. Steam at 100 pounds pressure is admitted to the space between the two shells, which drives off all moisture, the vapor being led away to the main combustion chamber. After being thoroughly broken up and dried, the manure is passed through a crushing mill, when it is ready for use. The cost of producing the manure works out at about one pound per ton, and it is sold at four pounds per ton.

In a paper read before the Association of Cleansing Superintendents in 1904, Mr. E. Call gives some particulars of the working of the fish manure plant of the Bradford Corporation. During the year 1903, 322 tons of fish refuse were dealt with, the revenue from which amounted to 260 pounds, of which about 200 pounds was clear profit.

Manufacture of Poultry Food.—Poultry food is manufactured at Blackpool from oyster shells, which are taken to the destructor works and crushed in a mortar mill. The value of the food is 7 shillings per ton.

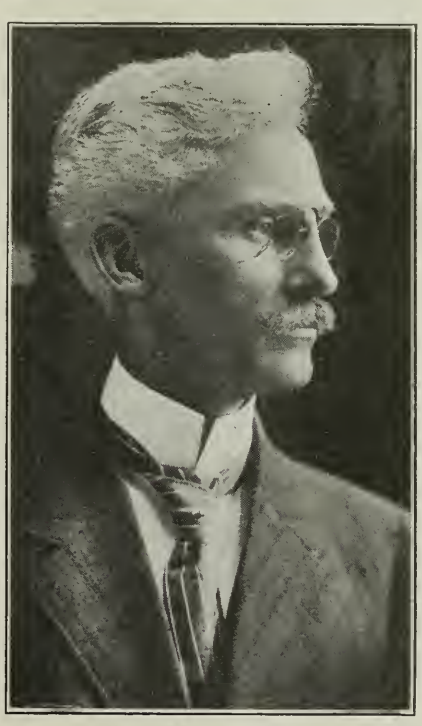
The City of Erie, Pa.

THE city of Erie has selected as the place for the next convention of the American Society of Municipal Improvements, in accordance with the policy which that association has followed for several years, and because of the attractive invitation given by Benjamin E. Briggs, who has been the city engineer for thirteen years through several changes in administrations. Erie is a progressive city of perhaps 70,000 population with one of the best harbors on Lake Erie, and is a bee hive of manufacturing industries, claiming to produce more engines and boilers than any other city in the world, and being almost equally notable for other metal products, electrical machinery, and with many other industries.

Location and favorable freight rates account for much of this, but the city government seems to be equal to its requirements, so that taxes and bonded indebtedness are low, while good service is given both in making public improvements and in operating public service industries. With an assessed valuation of more than twenty-five million, corresponding to some eight hundred million full value, the bonded indebtedness is only about $770,000 and a sinking fund of $410,000 is on hand to help extinguish this. The city tax rate is only 14 cents and the school tax 9 cents per $100.

Street car service reaches all parts of the city with 25 miles of line and there is interurban service to Cleveland, Buffalo, Chautauqua Lake, Warren, Meadville and Linesville, west, east and south. The electric lines have parks at Waldameer and Four Mile Creek, both on Lake Erie, and the city has 131 acres in four parks in the center, east, west and south, besides the lake side park along the harbor bay and Presque Isle, with its 175 acres of water works park and some 3,000 acres as yet undeveloped.

The city is thoroughly sewered and is now constructing intercepting sewers and a sewage disposal plant, which will be described more fully hereafter. It is now beginning the solution of the problem of garbage collection and disposal on modern lines.



BENJAMIN E. BRIGGS
City Engineer, Erie, Pa.

Two electric light and power plants, a heating company, a natural and an artificial gas company supply light, heat and power at more than usually liberal rates.

Thirty-three miles of the city's streets are paved with asphalt, and fifteen miles with brick and there are

still three miles of cobble-stone pavement left. City Engineer Briggs has devised systems of taking care of the repair of streets which reduce the expense to a minimum at the same time that they are very efficient. The methods and results have been reported from time to time in MUNICIPAL ENGINEERING and are worthy of careful study by other city engineers.

The water works of the city are remarkable for many things which demonstrate the efficiency of their management. The three members of the board are appointed, one each year, by the Court of Common Pleas of the county and are thus removed as far from politics as possible, especially since they manage the works in practical independence of any other department of the city government. One member of the board has been in office four years, another nine, and another, who is a civil engineer, fourteen. The secretary has been in office first for eighteen years as assistant and then for eight as secretary. The present mayor was a commissioner for nine years.

The water supply has heretofore been taken from the harbor, but an intake from Lake Erie on the outside of Presque Isle peninsula and settling basins on the peninsula are now practically completed and will shortly be in use. This will be one of the points of interest for those attending the convention of the American Society of Municipal Improvements. The accompanying photographs show first, the pumping station as seen from the bay; second, the swimming pool on the shore of the bay just to the right of the view shown in the first picture; and third, a view of the pool and the dressing cabinets and boathouse, taken from the roof of the pumping station. Further details of the new water works construction will be given later.

Purification of Dye Water

By Henry G. Crocker, Washington, D. C.

PURIFICATION of streams into which waste dye water has been turned from an ever-increasing number of woolen mills in this country and Europe has been one of the most difficult problems which has confronted the municipal boards. The subject has been brought forward again and again, and attempts have been made repeatedly to find a solution of the problem, but without success.

Recently, however, an experiment has been conducted in Yorkshire, England, upon a commercial scale and under the most exacting and difficult conditions, which promises to deliver the trade from an exceedingly difficult position. A plant was erected at a cost of more than 400 pounds ($1,950), and it has now been working daily for some time, turning out an effluent which, if not always colorless, is quite clear, entirely free from acid, and altogether innocuous, at a cost for labor and materials of less than two-thirds of a penny (1 1-3 cents) per thousand gallons treated. The plant is exceedingly simple. It consists of three parts—an elevated tank carried on brick piers, an old 30-foot boiler, with the flues removed and the ends made good, set at an angle of about 30 degrees, and another old boiler converted into a filter and standing vertically on end, all of which are connected by pipes 4 inches in diameter, having the necessary controlling valves. The plant is designed to deal with an average flow of 30,000 gallons in ten hours, but the flow may on occasion exceed 3,000 gallons in the hour. The elevated tank is simply a wooden reservoir about 20 feet by 10 feet, to hold about half a day's quantity. Into this tank the crude dye-water is pumped, and here it receives an admixture of lime in the proportion of 3 or 4 pounds of dry lime to every thousand gallons of the liquor to be treated.

From the tank the liquor is carried by a pipe to the bottom of the tilted boiler, or, rather, cistern—for it is only as a cistern that it is used. The outlet from the boiler is at the top of the incline, and the liquor flows in at the bottom—therefore against the whole weight of the contents of the cistern. It is in this device of using an inclined cistern from which all air is excluded for the purpose of a setting tank that the efficiency of the process consists.

I. WATER WORKS OF ERIE, PA. PUMPING STATION AS SEEN FROM BAY.

The Municipal Abattoir and Reduction Plant at Paris, Texas

By Ed. H. McCuistion, Mayor, Paris, Texas

THE successful installation and operation of small abattoirs or at least of plants adapted to the requirements of small cities, marks a distinct advance in sanitation as it relates to meat food products. On the 1st of December, 1909, the city of Paris, Tex., commenced the operation of a plant, which, judging by the interest manifested, has attracted wide attention both in the United States and Canada. While we usually refer to it as the abattoir, as a matter of fact it is really more; it is a combination abattoir, cold storage and reduction plant.

The complete cost and equipment of it was $10,000.00. It is situated on one of our main streets just about one mile from the center of the commercial district of the city. Our equipment consists of a sixty horsepower boiler and a twenty-five horsepower engine, steam being the motive power used. The refrigeration is produced by a ten-ton ice machine, so arranged and constructed as to produce excellent dry refrigeration. The killing room and the chill and refrigerating rooms all have solid concrete floors, which are carefully laid to grade, trowel-finished and equipped with bell traps, which insure not only prompt, but perfect, drainage, and each trap being equipped with water seal, guarantees that these rooms will not become contaminated with sewer gas.

The reduction machine used by us is manufactured by Wannenwetsch & Co., of Buffalo, N. Y. It stands on end and looks almost exactly like an upright boiler. The charge is put in at the top, which is on the second floor of the building. When it is filled and sealed, steam is turned on through a steam jacket which lines the boiler, and a vacuum pump is put immediately to work, which takes off the gases liberated by the cooking process. These are conducted through a condenser, and all that can be condensed are then trapped out to the sewer. Those that cannot be condensed are carried by an iron pipe and discharged immediately under the firebox of the boiler, and are carried by the draught through the fire-tubes of the boiler and the smoke-stack and have never given us any trouble.

The cooking process in the rendering tank is continued, depending somewhat upon the character of the charge, for about 5 to 7 hours, then the steam is cut off and the charge immediately begins to settle. The bones and all solids go to the bottom, the water (called stick water) is next and the grease is on top. When time is given for this arrangement to have fully taken place, the operator then draws off the grease through a valve and then the stick water in the same way, which goes into the sewer. When this is finished the valves are closed and steam is again turned on, and the drying process begins. This takes from 4 to 6 hours, making in all usually from 12 to 14 hours. When dry and thoroughly macerated, or I should more properly say, powdered, a cart is backed up to the base of the cooker and the hermetically sealed door is opened and the agitator pushes the entire charge into the cart. This product is called tankage and is sold by us to the farmers for fertilizer. It is worth by actual analysis $23.49 per ton, and is well balanced in its chemical proportions.

The reduction plant performs two very important functions. All offal, blood, feet and waste from the killing room are carried by hoist and overhead trolley to the reduction room and emptied into the rendering tank. Then all the dead animals which accumulate in or about the city are at once removed to this plant. Such as hogs, dogs, cats, rats, chickens, etc., are put in whole, but cattle and horses are skinned and quartered before being placed in the tank. Every well-equipped plant should have two tanks, so that while one charge is being cooked the other tank is being filled. In this way the entire premises can be kept perfectly sanitary and almost absolutely odorless. The cooking process does not emit odors as one would naturally think, no matter how putrid the charge, if the operator is careful to seal his tank properly. There is an odor to the tankage which, while entirely distinct from a putrid odor, is nevertheless unpleasant, and it should be removed to a warehouse about 100 feet away and no inconvenience will be experienced.

II. WATER WORKS SWIMMING POOL AT ERIE, PA.

Our reduction plant is so intimately associated with the balance of the plant that it is impossible to determine with absolute accuracy, but it is our judgment that the reduction feature of our plant is self-sustaining. The products of the plant are tankage and tallow, the first being worth $23.49 per ton and the latter on an average 5 cents per pound. In addition a further small income is derived from the horns of cattle and the tail-brushes of both.

I have apparently laid considerable stress on the reduction feature of the Paris plant, but I would have those who are interested bear in mind the very important function performed by such a plant in the successful management of the abattoir proper.

In adapting the size of an abattoir to the requirements of a particular city the data in most instances can be secured from the local meat cutters. In this city we tabulated these data as carefully as we could and reached the conclusion that a killing room 22 feet square and a chill room 10x11, and then a refrigerating room 22x40 would about give us the capacity we desired. Paris has a population of about 15,000 and consumes on an average of 150 beeves, 200 head of hogs and 50 calves and sheep per month. In the summer months the number of hogs will be diminished and the number of beeves will be slightly increased, though more meat is consumed in the fall and winter months than during the summer. Our refrigerating room is supposed to hold 75 beeves and 100 head of hogs. One feature of our cold storage deserves special mention. The ammonia pipes are all overhead and so arranged that if the frost melts off the water is caught and trapped out of the building at once, thereby keeping the air dry and keeping all the carcasses free from slime and discoloration.

On the same lot with the abattoir are located stock pens, where all the local butchers deliver the animals they wish slaughtered. Our inspector then makes the live inspection. From the pens through a runway, which is screened, they are driven and slaughtered. The hide is removed from the cattle, the offal and blood are sent to the rendering tank and the carcass is rolled upon the inspector's rail for the dead inspection, which includes an inspection of both the carcass and the viscera which have been removed from it. When properly stamped and tagged, it goes into the chill room, where it remains usually about 12 hours, at a temperature of 40 degrees. The carcass is removed into the refrigerating room, where it remains at a temperature of 30 for four days, without charges for refrigeration, but after the four days 10 cents for beeves and 5 cents per day for hogs, sheep and calves is charged for cold storage.

When the carcasses are called for by the meat cutters they are rolled into a checking room, a bag with a drawstring is slipped over them and carefully tied so as to preclude the possibility of contamination by dirt or dust. These are then placed in a specially built wagon and carefully protected from dust, flies, etc., by a further covering and delivered to the meat cutters.

The following is a detailed statement of our April business

INCOME.

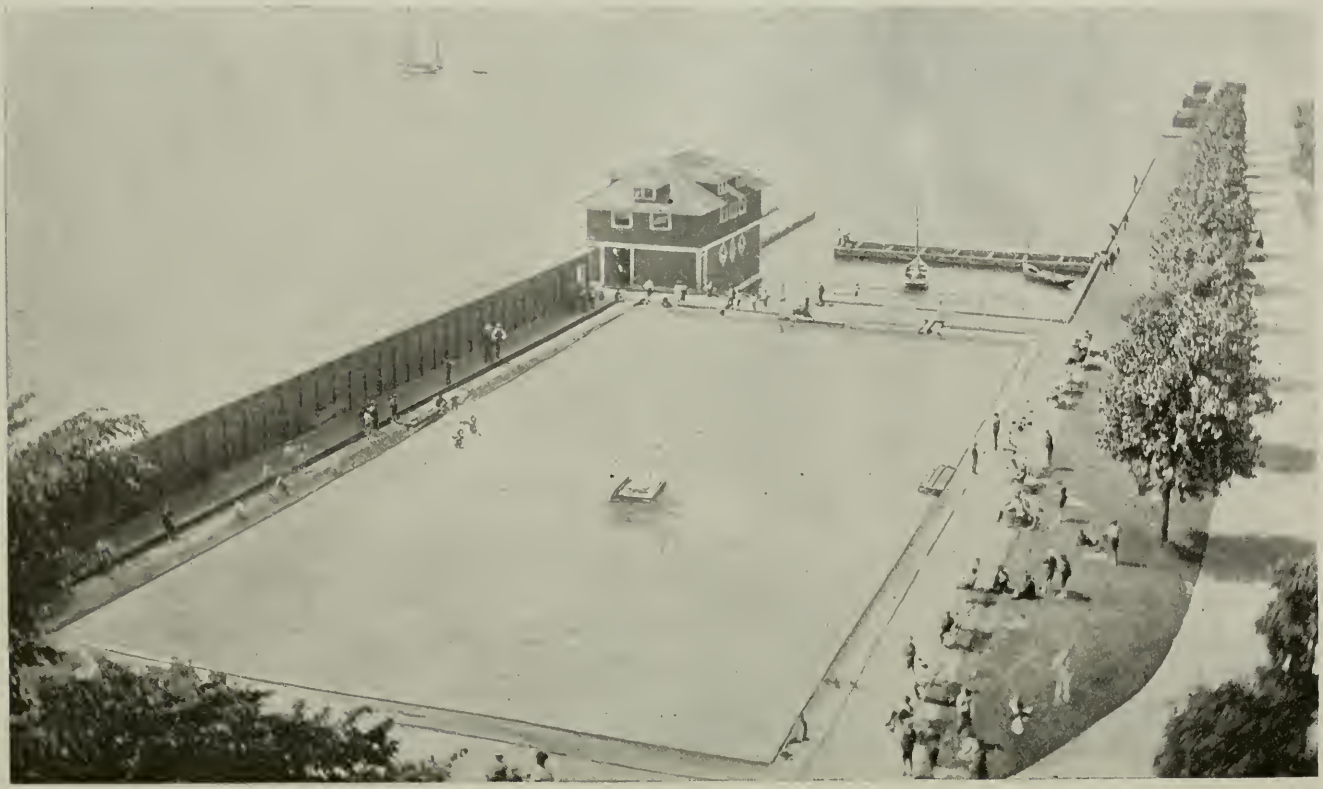
Beeves—149 at $1.25	$186 25
Hogs—152 at 75c	113 00
Calves—30 at 75c	22 50
Tallow—2,819 pounds at 5c	140 95
3 hides	5 60
Tankage, $20.00	100 50
Inspectors' fees	43 05
Total	$611 85

EXPENSES.

Inspectors' salary	$100 00
Engineer and manager	75 00
Slaughtering (contract)	175 00
Dead-stock man	45 00
Night help	60 00
Fuel, oil and waste	100 00
Total	$555 00
Balance to credit	$56 85

It will be observed that the charge of $1.25 for beef includes the live and dead inspection, the slaughtering, cold storage, and delivering to the meat cutter's shop. The 75 cents for hogs, sheep, goats and calves includes the very same services.

When the expediency of such a plant was under consideration our meat cutters did not manifest a disposition to enter heartily into the plan, but its practical operation has pleased them all, and there is not one who would willingly go back to the old order of things. No city where slaughtering is carried on in the old primitive way will continue it when modern abattoirs are once brought to its attention.



III. WATER WORKS OF ERIE, PA. BOAT HOUSE, DRESSING CABINETS AND SWIMMING POOL.

Hydrated Lime

By Richard K. Meade, Nazareth, Pa.

TO combinations of an oxide with water the chemist gives the name hydrate. The compound composed of sodium oxide and water is called sodium hydrate. Similarly, the compound composed of calcium oxide, popularly known as lime, with water is called calcium hydrate, or more familiarly, hydrated lime.

This compound is formed when 56 parts of lime unite by slaking with 18 parts of water, and hence is composed of 76 per cent. lime and 24 per cent. water. If we should add more than 18 parts of water to 56 parts of lime, the quantity of water in excess of 18 parts would either be driven off by the heat generated in slaking, or else if much in excess would remain with the slaked lime. The excess of water does not combine with the lime, but merely stays behind as water, forming with the lime a wet mass or putty. This is what takes place when lime is slaked by the mason in the mortar box. Fifty-six pounds of lime can combine with only 18 pounds of water, no more, no less; and if the proportions of water and lime have been greater than 18 to 56, as is always the case with hand slaked lime, the water remains in the box as such, forming with the hydrated or slaked lime, the lime putty which the mason uses. If the proportions of lime and water are exactly or very nearly 56 to 18, all the water is absorbed by the lime and the product is a dry powder and this dry slaked lime is called hydrated lime. Thus hydrated lime is nothing more than dry slaked lime.

If a lump of lime is left in the air it gradually falls to a powder or air slakes. There is always present in the air moisture, and if this were the only compound in air, air-slaked lime would be just as good as hydrated lime or lime putty. Unfortunately, however, the air also contains carbon dioxide. This latter gas unites with the lime to form carbonate of lime, or limestone. In other words, the carbon dioxide of the air unites with the lime to form the substance from which lime was made; namely, limestone, so that when lime is air-slaked, while a small quantity of hydrated lime is produced, there is also a large quantity of carbonate of lime formed, and this latter is as inert and incapable of furnishing a mortar as would be so much ground limestone.

Hydrated lime itself does not absorb carbon dioxide from the air, provided it is dry, neither does it absorb moisture. Lime, on the other hand, absorbs moisture greedily from the air ,and at the same time along with it a large quantity of carbon dioxide. This is why hydrated lime will keep indefinitely, while quick lime rapidly slakes, and falls to a powder. Quick lime in slaking increases in volume and constantly swells and bursts its barrels. Hydrated lime absorbs nothing on storage, consequently it does not swell or change its volume, hence there are no troubles with bursted barrels and consequent loss.

When lime slakes, as every one knows, a great deal of heat is given off. This heat is due to the chemical reaction between the lime and the water. When charcoal burns in air, heat is given off because the carbon, which charcoal is, unites with the oxygen of the air, and this is what we call burning, because heat and light are given off. In the case of quick lime, exactly the same sort of process takes place. Heat is given off, although no light. One pound of lime in slaking gives off 2,700 British thermal units, or in other words, 5½ pounds of lime will give off just as much heat in slaking as one pound of coal will in burning. This explains why so many fires occur in lime storehouses and in sheds in which lime is kept. Rain, or even the moisture of the air gets to the lime, slakes this, and fire results from the heat generated, this usually starting with the wooden staves of the barrels, etc. With hydrated lime on the other hand, the lime has already combined with its fill of water and hence can not combine chemically with any more water, and as no chemical reaction can take place no heat will be generated. Lime, therefore, may be considered as a combustible body, liable to give off heat by uniting with the moisture of the air, etc., just as coal will give off heat by uniting with its oxygen. Hydrated lime, on the other hand, is as inert and incapable of giving off heat as so much well-burned ashes. In the storage of hydrated

lime, therefore, there is no danger of fire and it may be shipped in paper and cloth bags. This freedom from fire risk, makes hydrated lime an ideal substitute for quick lime so far as the dealer is concerned.

For the processes of hydrated lime manufacture, where this is done thoroughly and to the best advantage, considerable machinery is required. The lime is first crushed to one-fourth inch size and under in order that the water may have a chance to get to it thoroughly. The crushed lime is then mixed with exactly the right quantity of water required to hydrate the lime. This water is determined by experience, and such an amount is added that the lime will be completely hydrated, and that the small amount in excess, which is always necessary, will be driven off as steam by the heat given off by the lime itself in hydrating. The mixing of lime and water is usually done in large steel cylinders. In these the lime and water are thoroughly mixed with paddles, so that every particle of lime comes in contact with water. After the lime has been thoroughly hydrated, it is passed over screens. These separate the fine hydrated lime from any unhydrated cores or lumps. This explains why hydrated lime is superior to lime slaked in the mortar box.

In order to keep lump lime it is necessary to burn the latter so that the outside of the lumps are slightly fused or over-burned. If this were not done, the lime would slake in transit, when shipped in bulk. There is also present in all limestone a small percentage of sand and this unites with some of the lime in burning to form clinkers. This hard over-burned lime, and also these clinkers do not slake readily with water, therefore, when lime is hand slaked, unless the latter is given considerable time to season in the mortar box, these hard cores do not slake. When the mortar is applied to the wall, however, slaking of the cores gradually takes place. Since slaked lime occupies more bulk than quick lime, the slaking of these cores causes expansion or "popping" and this makes itself evident in the form of blisters and blow-holes in the wall. In the mortar box method of slaking, these cores frequently remain unslaked, while in well made hydrated lime they are screened out.

Hydrated lime can be used for every purpose for which quick lime is used, and also for all purposes for which lime putty is used. It has also some uses which neither have. It, however, does not trowel quite so easily as lime putty, and this has been the greatest objection on the part of the mason to its use. By employing a good deal of water in the mortar, however, this objection can be to a great extent removed. The greater convenience with which it can be handled and used, however, and the thoroughness with which it has been slaked, to a large extent make up for this trouble. No mortar box is required and the hydrated lime and sand may be mixed upon a board, just as are cement and sand. It is, therefore, especially convenient for doing small jobs, such as repairs to plaster, etc.

It is estimated that it costs 25 cents per barrel to slake lime in a mortar box. This expense is saved by the use of hydrated lime. Furthermore, the mixing can be done indoors and in cities the streets are not blocked.

In using hydrated lime the mason should remember that not quite as much water would be required as is the case with lump lime, because in the case of quick lime some water is needed to combine with the lime, and in case of hydrated lime this water has already been supplied by the manufacturer. Where a mortar box is used, it is usually considered best to first place the water in the box and then the lime. More water and then lime can be added as necessary, the idea being to get a thorough mix of water and lime. It is usually considered better to allow the mixture to remain over night. Such a mortar can be used just as lime putty, and if plenty of water has been employed, will trowel very similarly.

One place where hydrated lime can be used, where ordinary lime putty can not be employed, is with Portland cement. The addition of lime to Portland cement is not an adulteration, but confers a great many good properties to the latter. It has long been known that slaked lime would waterproof concrete. This is due to the fact that it exists in the form of an extremely fine powder, many times finer than the finest ground cement. This fine powder fills in the pores of the concrete and stops them up, thus excluding the water. Owing to the difficulty of mixing the wet lime putty with the dry cement and sand, however, it has only been since the introduction of dry hydrated lime that slaked lime could be used for waterproofing. It is generally considered that hydrated lime is the best waterproofing compound which

can be added to cement, and that it is superior in lasting qualities to any of the water-proofing compounds at the present time advertised for this purpose. The writer has tested some eight or ten of these compounds. In every instance, without exception, they decreased slightly the strength of the cement mortar made therefrom, and he does not think that any of the manufacturers claim that they add to the strength of concrete. Hydrated lime, on the other hand, not only waterproofs the concrete, but numerous tests made in different laboratories by disinterested parties show that additions of hydrated lime up to 15 or 20 per cent. increase the strength of cement mortar.

As an actual waterproofer, hydrated lime is not surpassed by any of the waxes and paraffin compounds at the present time used for this purpose. Many of these compounds are organic, and in time will volatilize, leaving the concrete porous. Hydrated lime, on the other hand, is inorganic or mineral and will remain where it is put.

As an example of the waterproofing properties of hydrated lime, this was employed upon a large gas holder at Kingston, Ont., which had been practically a failure, owing to the leakage of the concrete wall of the gas holder. A number of waterproofing methods were tried, all of which failed, and it was not until this wall was chipped back from three to six inches by means of pneumatic chisels and a new wall composed of concrete, containing about 18 per cent. of the weight of the cement of hydrated lime had been added, that the tank was waterproof.

The addition of hydrated lime to cement makes the latter more plastic and easily trowelled. It also improves the adhesive properties. A mixture of equal parts of hydrated lime and Portland cement makes an ideal mortar for laying brick. The addition of hydrated lime to concrete blocks makes the latter whiter, tougher, and waterproof.

Hydrated lime is not only the best but also the cheapest waterproofing compound known, since it replaces so much cement and the only additional cost is the difference between the price of cement and hydrated lime, which is slight, even at the present low price of cement.

For household, agricultural and industrial purposes, where only a small quantity of lime is used and where storage in the cellar or a shed upon the premises is desirable, hydrated lime is unsurpassed, owing to the fact that it can be easily mixed and handled, keeps indefinitely, is put up in small paper packages (40 lbs.), and finally that there is no danger of fire from it. Lime has long been used as a disinfector, for whitewashing, for fertilizing, for spraying fruit trees, for purifying of water, for marking lawn tennis courts, and for all of these uses hydrated lime possesses every property of quick lime. For such uses as water purification, disinfecting, fruit spraying, etc., magnesian hydrated lime has only about one-half the value of the high calcium hydrate.

Hydrated lime is usually packed in 40-lb. paper bags or 100-lb. cloth bags. The paper bags are of the valve type, and are pasted shut at both ends, presenting a square package, which can be easily handled and, owing to the absence of the rough tied end found in cement bags, can be closely packed. Below are some standard formulas for the use of hydrated lime:

GENERAL DIRECTION.

First cover bottom of mortar box with water and add the hydrated lime and more water as is necessary. Some mechanics prefer to soak the hydrated lime at least twelve hours before using, claiming more plasticity in its manner of working.

FOR PLASTER MORTAR.

First or Scratch Coat.—350 lbs. hydrated lime, ¼ yard screen sand, 2 bushels hair. Should cover about 100 square yards.

Second Coat.—200 lbs. hydrated lime, ½ yard screen sand. Should cover about 100 square yards.

Putty or White Coat.—Use about one-half as much plaster to gauge with as is commonly used with putty made from lump lime. If wall is dry sprinkle or dampen with brush before putting on white coat as labor will be lessened.

Float Finish.—300 lbs. hydrated lime, ¼ yard screen sand. Should cover about 100 square yards.

For Stone Mortar.—200 lbs. hydrated lime, ⅝ yard screen sand and add water.

For Brick Mortar.—250 lbs. hydrated lime, ⅝ yard screen sand.

HYDRATED LIME AND PORTLAND CEMENT MIXTURE FOR LAYING BRICK AND STONE.

For hard mortar for these purposes use equal parts by weight of hydrated lime and Portland cement. Add re-

quired amount of sand to properly gauge up mortar.

FOR WATERPROOFING CONCRETE AND CONCRETE BLOCKS.

Replace 15 to 20 per cent. of the weight of the cement used in the mortar by hydrated lime.

To Sum Up the Advantages to the Dealer.—It is first of all a fixed product which does not deteriorate or change with age, nor swell and burst its packages, consequently it is always worth the market price of lime. Second, it can be handled without risk of fire, and, third, it can not only be used for all purposes for which lime is used, but also has many new uses, and is more convenient of application.

It has been aptly said that hydrated lime is the twentieth century way of handling the lime trade.

The Water Works of Springfield, Ohio

THE first trustees of the Springfield, O., water works were O. S. Kelly, J. H. Thomas and George H. Frey. These men met to organize on January 19, 1881. About one year previous all of these trustees were members of council and that council in March of 1880, by resolution, appointed a special committee to investigate the subject: "as to the necessity for a water works system and whether the same should be constructed and owned by the municipality, or, whether it would be better to give the franchise to a private company." This committee, notwithstanding the opposition of many citizens and the efforts of those who wanted the franchise, recommended that the municipality should install and own the water works.

The original works contemplated an expenditure of $400,000, but, when completed as planned, the records show the real cost to have been $389,823.43, a difference of $11,176.57.

The original plans contemplated a pumping station of a total capacity of 4,000,000 gallons every twenty-four hours, with twenty-nine miles of water mains ranging from four to twenty-four inches in diameter and with three hundred fire hydrants distributed throughout the city. Also a stand-pipe with a storage capacity of 592,000 gallons and the purchase of seventy acres of ground.

The principal trouble in the past has been the supply end of the business. The aim has been at all times to provide water from a subterranean source. The history of all water works where the attempt has been made to supply the growing demand from a subterranean source, that is supplied by rainfall on large surface and thus stored in the gravel strata, has been, that during the drought period covering a shortage of rainfall for sometimes two or three succeeding years, the storage capacity is not sufficient to carry over until the more abundant rainfall seasons, which increase the volume of springs and restore the depleted storage in the gravel strata.

The nature of the valley, in which the pumping station is located, is as follows: First, four feet of black loam, then eighteen feet of coarse gravel, then the hard pan. The well from which suction is taken is thirty feet in diameter and excavated through the loam and gravel to the hard pan, a depth of twenty-four feet. Thus as the level of the water in the well is lowered the water level in the gravel stratum all over the affected district is lowered. The voids in this gravel stratum are twenty-five per cent. of the cubic contents, giving a storage of about 87,000,000 gallons.

The gravel deposits from which the water is at present derived are about 155 acres in area with a depth to hardpan varying from 28 ft. near the collecting well to 16 ft. near the boundaries of the deposits. They are separated by a narrow point in the valley from other gravel deposits lying in a much larger basin to the northwest. The depth of hardpan in the upper deposits varies from 28 to 21 ft. below the surface, as far as the borings show. The absolute level of the hardpan in the lower deposits varies about 10 ft. while in the upper deposits the variation is not over 8 ft. The water level, of course, in the lower deposits varies greatly with the amount of water being pumped, and in both deposits with the dryness of the season. In 1900 the water level in the lower deposits varies from 1 to 11 ft. below the surface of the ground, the absolute difference in level of the ground-water surface being about 17 ft. In the up-

per deposits the depth below the surface of the ground varies from 2 to 5 ft., while the absolute variation in the level of the surface of the ground water is about 10 ft. The effect of pumping is noticeable in the lower basin in the great variation of the water level, both with respect to the surface and datum plane. A profile taken longitudinally through both gravel deposits and giving the elevation of the water level would show no very abrupt change in the passage from the upper deposits to the lower. The land owned by the city lies entirely in the lower deposits on the east side of Buck creek and is about 56 acres in area. This includes the land on which the pumping station, collecting well and open reservoirs are located and in which the supplemental system and distributing tile are laid.

During the most severe and continued drought period, seven months of 1908, this effective gravel bed without the assistance of any rainfall supplied three and one-half million gallons per day.

The city's demands are no less than 5,000,000 gallons. The creek water, especially during the summer months, is not potable without filtration. The elevation and location of the water works land is such that by installing a distributing system the creek water could be flowed on to all, or, any part of this surface at will and there it could percolate down through the four feet of loam and into the eighteen feet of gravel strata and travel a horizontal distance of three-fourths of a mile to the well. This idea has been adopted and a reinforced concrete dam was built and is now in use and giving better service than anticipated. This dam is so located and the elevation is such that mechanical filters can be installed at the pumping station with a capacity of the full volume flow of the creek, if necessary, 25,000,000 every twenty-four hours. It is evident, therefore, that this plan will provide an abundance of water until the city reaches 300,000 inhabitants.

The accompanying photographs show the interior and exterior of the pumping station. There are three sets of pumps, one 10,000,000, one 7,000,000 and one 5,000,000 capacity. The water pumped during 1909 averaged 4,226,164 gallons per day, or a per capita consumption per day (based on a population of 40,000) of 105 gallons.

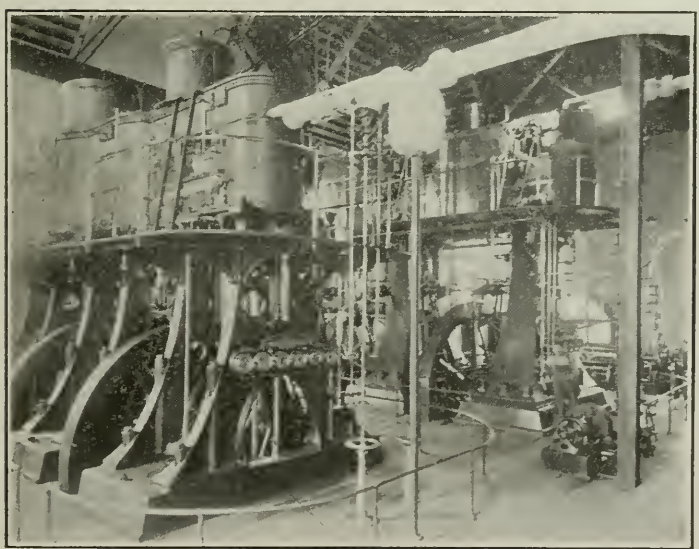
But where meters are installed on domestic service this per capita consumption is reduced to thirty-eight gallons, or a reduction of sixty-three per cent. Assume that sixty per cent of the total water is used for domestic purposes and the balance of forty per cent goes to business, fountains, street flushing, manufacturing, etc. Taking then for comparison sixty per cent of the total water pumped in 1909 (925,533,225 gal. domestic service) then apply the sixty-three per cent reduction in consumption due to the installation of meters, this amount is reduced to 342,447,294 gal. or 36 gallons per day per capita for domestic service. Now take the business houses, factories, etc., and suppose they consume twenty per cent of the total water pumped, leaving twenty per cent as representing free use, such as schools, city building, fire and police department, street flushing and sewers, then twenty per cent of the total water pumped last year is 308,511,075 gallons for factories, etc., and a like amount for public purposes. Experience shows that in the use of meters the waste of water in this class of service (business and factories), is reduced approximately fifty per cent. This would reduce the consumption of water in business houses and factories from 308,511,075 to 154,255,537 gallons. Then allowing the free use for municipal and fire purposes to remain at 308,511,075 gallons per year, the total consumption for a year, instead of being 1,542,555,376 gallons as consumed in 1909, under the meter system, would be 805,513,888 gallons, a reduction of 737,341,488 gallons, or, forty-eight per cent.

At the close of business December 31, 1909, the total mileage in the distributing system was 85 37-100 miles, ranging from three to twenty-four inches in diameter with 742 valves, 622 fire hydrants and 7,168 private services. The increase of private services averages about 300 a year. The revenue from new business is about $2,000.00 a year.

The system is a stand-pipe system. The pressures on the distributing lines due to the differences in elevation at the minimum vary from 38.2 to 97.8 pounds.

Within a short time the superintendent will have plans for the installation of a motor-operated valve on the twenty-four inch line running into the stand-pipe and while the stand-pipe will always be in use, yet, when an alarm of fire comes into the pumping station, the engineer on duty will throw in a switch and immediately the valve on inlet to stand-pipe will close and the pumps will be speeded up to

WATER WORKS PUMPING STATION AND SMALL RESERVOIR,
SPRINGFIELD, O.



INTERIOR OF WATER WORKS PUMPING STATION, SPRINGFIELD, O.

produce whatever pressure is desired up to 250 pounds, if need be.

The water plant could then take the place of most of the fire engines now in service at a saving of $1,460.00 a year, equivalent to an investment at six per cent. on $24,000.00, while the actual cost of the equipment and installation would not be more than $5,000.00 and in the operation the cost would be nothing.

At the close of business December 31, 1909, there was invested in the water works $905,120.03, with a balance of indebtedness outstanding of $345,000. The retiring of the capital invested differs from the plan of any private corporation in that they never retire their capital stock.

The cost of operation of the water works approximates about $26,000 per year. For the year 1909 the cost was $22,451.84; 1907, $27,093.13.

The water department has voluntarily asked for reductions in appropriations several times in the last two years. These good results as to economy in operation are due almost exclusively to the elimination of politics.

The total revenue of the department for 1909 was $77,541.75. The operating and maintenance costs were $22,451.84. Taking an average cost of operating and up-keep of $25,000 and an income of $80,000, the net earnings would then be $55,000 per year, or six per cent. on an investment of $916,666. But to find the real value of the investment a value must be placed on the free use of water, and from such value deduct the amount of taxes if the works were owned by private interests.

An estimated value of the free use of water is as follows:

Schools (actual)	$ 2,200.00
City building	1,000.00
Flushing streets and sewers.	2,500.00
Parks	1,200.00
Fire and police department..	800.00
Fountains and water troughs	4,000.00
622 hydrants at $30 each....	18,660.00
Cemeteries	500.00

Total value of free use of water $30,860, less $12,000 for taxes, leaves $18,000, and adding this amount to the revenue of $80,000 per year gives us the real income as $98,000. Then taking operating cost at $25,000 leaves a net income of $73,000. Capitalizing this net income at six per cent shows a value of the works of $1,216,666, or, $311,545.97 more than the works cost.

The department, during the last year, has investigated rates in use in other cities, in order to make comparisons. Data from 375 cities ranging in population from 25,000 to 50,000, 165 being private plants and 210 municipal, show an average cost on the basis of a six-room house, with kitchen sink, bath, closet, wash basin, sprinkling 50x140 feet lot and street, as follows:

Domestic service.	$6.83	$6.04	$4.00
Bath	3.88	2.99	2.50
Closets	3.69	3.12	2.50
Wash stand	1.94	1.55	....
Sprinkling	6.17	4.37	5.00
Totals	$20.38	$16.34	$14.00

Meter rates per 1,000 gallons: Private plants, 10c to 31c; municipal plants, 7c to 21c; Springfield plant, 6c to 10c.

The average switching charge on a car inside of the city limits is $4.00, on the basis of thirty-ton cars about 13c per ton, and water at 10c per 1,000 gallons is less than 2½c per ton. Therefore, the cost of water delivered at 10c per 1,000 gallons is less than the cost of switching a car on the basis of 2½c per ton.

During the last two years no unfiltered water has been used, and as a result the typhoid fever reduction has been most gratifying. After abandoning the direct use of water from the creek in 1908, there was an immediate reduction of 64 per cent covering 1908, and a further reduction of 30 per cent in 1909 over 1908. Thus it is shown how necessary it is to provide pure and potable supply.

The pumps in every day practice are doing about 80,000,000 foot pounds of work with each 100 pounds of coal consumed.

We are indebted for most of this article and for the photographs to George S. Cotter, the superintendent of the water works.

Handling Coal and Ashes at the Peoria Lighting Plant

REDUCING the cost of labor and minimizing the handling of materials in power plants is becoming more necessary every day and consulting engineers situated in every part of this country are constantly on the alert to adopt the simplest and most practical methods for keeping down the operating cost. The unusual conditions prevailing at the power house of the Peoria Gas and Electric Co., a corporation operating over 4,100 h.p. of boilers, supplying the light and power at Peoria, Ill., necessitated a special type of mechanical equipment for the conveying of their coal directly from the cars to the fires under the boilers and handling the ashes from the ash pits.

The accompanying illustrations comprising a drawing and two photographic views show how this is accomplished, and on account of the limited space we describe only briefly the distinctive features about this mechanical equipment, which was designed to handle 50 tons of either coal or ashes per hour, but as a matter of fact it is frequently handling double that tonnage.

The fuel that is being used is "run-of-mine" coal, which is delivered alongside the plant in 30-ton railway cars. Figure 1 shows a plan and elevation of the entire power house with the equipment in place; it will be seen that the cars may be either dumped into the track pit or unloaded direct from the car by the grab bucket, which is operated by cable and electrically driven double drum hoist situated on the cantilever tower, as will be seen in photograph, figure 2.

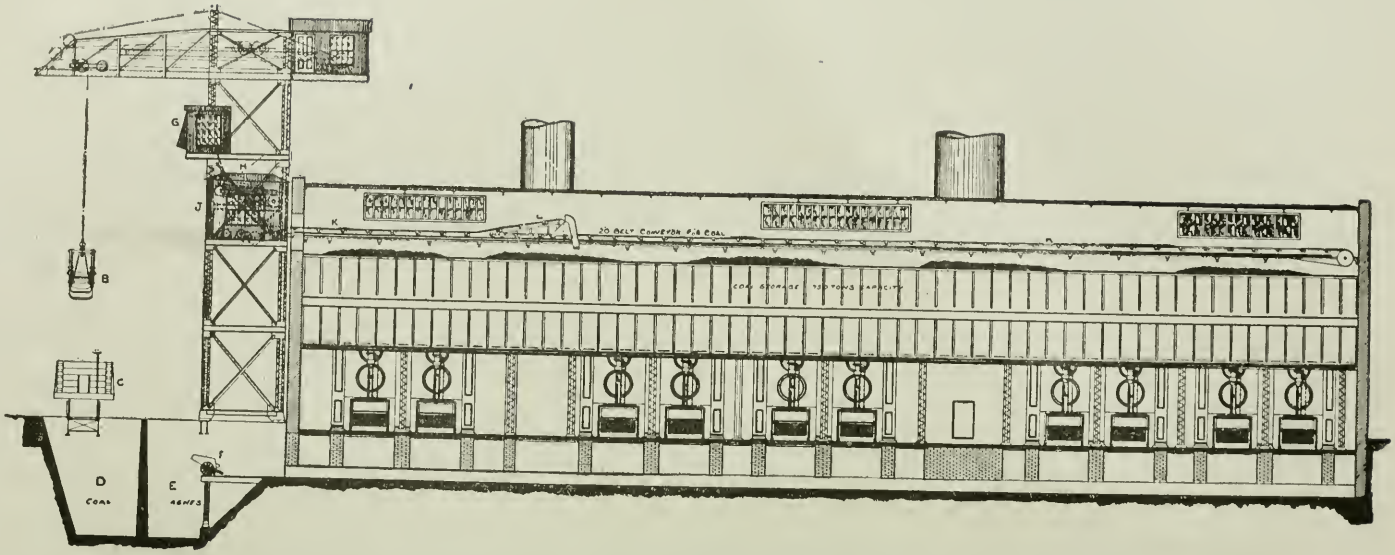
The coal is dumped from the bucket through the receiving hopper placed in the tower to a two-roll crusher, electrically driven. This is accomplished by means of a reciprocating plate feeder equipped with a perforated bottom, which allows the fine coal to by-pass around the crusher, delivering only the large lump coal to the crusher rolls. The coal passing through the rolls is delivered to a belt conveyor, which deposits the crushed coal into the storage bunkers by means of a traveling tripper. The bunkers, having a capacity of over 750 tons of coal storage, are so constructed that they feed the coal directly to the automatic stokers by gravity.

Figure 3 shows a photograph of the belt conveyor house above the bunkers. The conveyor is 225 feet between centers and is 20 feet wide and is 6-ply Jeffrey standard canvas belting. The top strand of this belt is carried on a three-pulley troughing idler; the return strands being carried on two pulley straight face idlers. This conveying belt is equipped with an automatic self-propelling and self-reversing tripper, provided with a brush for cleaning the belt and also a two-way discharge spout for distributing the coal evenly along the storage bunker.

The operator on the tower has his station in the cab and operates two controllers, two clutch levers and one foot lever to handle and control all the movements of the buckets. Windows are provided in the tower to enable the operator to look in all directions. A single laborer is needed part of the time in the car to clean up the coal that cannot be reached by the grab bucket. The bucket will handle nearly every particle of coal, and at no time will more than ¼ ton remain in the car.

The tower is built of structural steel, weighing approximately 65,000 lbs., towering in height 71 ft. The cantilever truss is a trifle over 30 ft. long and is counter-balanced by the machinery house. The method adopted for the removal of the ashes is simple and is explained by referring to the drawing (Figure 1), the ashes coming from the ten fires into the deep steel barrows and being taken to the ash pit, where they are loaded to the railway cars by the grab bucket.

This entire equipment was designed, built and erected by the Jeffrey Manufacturing Company of Columbus, Ohio. The results of the official tests made by the engineers in charge for the Peoria Gas and Electric Co. have also been made known to us and are published here only in a brief way. On May 19, C., P. & St. L. car No. 1125, containing 30 tons of fine coal, was unloaded by the grab bucket in 25 trips, averaging one and two-tenths tons of coal per trip, in less than 25 minutes. The total cost of labor and actual power consumed for the entire 30 tons amounted to less than 40c. The cost per ton for handling the coal for the previous three months ending March 31 showed a total net saving of over 16c per ton, compared with the former methods, when only labor had been used for this same purpose, and the actual saving of over $10,000.00 for the first year with the use of this modern installation.



I. SECTIONAL BRAWING OF POWER HOUSE PEORIA GAS & ELECTRIC CO., PEORIA, ILL.

Water Purification by Ozone

THE utilization of ozone for the purification of water for municipal supply is a familiar development in European countries and in comparison to other purification methods it holds a very favorable position. The authorities of New York City, however, in a recent test and report on the subject found that while the bactericidal value of the process is beyond question, the efficiency, from a mechanical and operative viewpoint, is exceedingly low, inasmuch as practically only 25 per cent of the power required for the operation of the plant was available for the actual production of the ozone, the remaining 75 per cent being required to operate auxiliary units. There are practically no plants of this character in this country and the result of this investigation and report would not be likely to encourage their installation. A recent installation at Lindsay, Ontario, however, on slightly different lines will, in all probability, put a somewhat different light on the subject.

In the European installations electricity is used to produce the ozone almost exclusively. The air is brought into contact with the brush discharge from the high static terminals, with the production of ozonized air. The average ozonizer consists of a rectangular iron box containing a number of plates or smaller boxes, insulated from the containing box and from each other, and connected to a high voltage current. The air after passing through the ozonizer and becoming saturated with ozone is then mixed completely with the water, and as a result the water is purified so rapidly that it can generally be accomplished in the short time that is necessary to free the air from the water. In the European installations an air compressor is used for handling the air and a refrigerating machine for removing the moisture from the air before its entrance into the ozonizers. It was found that the amount of ozone produced in the passage of the air over the electrodes was dependent to a great extent upon the hygrometric condition of the atmosphere, and the refrigerating machine was considered necessary for the efficient production of the ozone for this reason. Chemical dryers have been used with more or less success but the refrigerating machine has taken precedence from an efficiency point of view. The operation of the air compressor and refrigerating machine as auxiliary units is responsible for the low efficiency as noted in the report of the New York City officials mentioned above. The recent installation at Lindsay, Ontario, in accordance with the plans by Mr. J. Howard Bridge, has eliminated these auxiliary units. The refrigerating machine was considered necessary for the removal of the moisture from the air, but in this recent installation the cooling of the air is by water, with a resulting deposition of a portion of the moisture by this process. Again, the air is handled completely throughout its course through the ozonizers and into and through the water by means of hydraulic agencies entirely, the flowing water sucking in the air by means of aspirators, the commingling of the air and water being accomplished in much the same manner as that employed in the Taylor hydraulic air compressor installed at Magog, Quebec, and in a number of other places.

The Bridge development was installed at Lindsay in an attempt to improve the character of the water supply for this place. The water was taken from a lake and swamp and was surcharged with vegetable and animal matter at certain periods of the year to such an extent as to render it most unpalatable and furnish rich nourishment for bacterial development. The total cost of the new installation did not exceed $7,000, with an operating expense per annum of about $300. The amount of water purified was 1,500,000 gallons per day, making the expense approximately fifty-two cents per million gallons. The ozonizers occupy a small brick building 8x10 feet in dimensions, built against the pumphouse of the city station. No air compressor is needed, as the air is handled by the water entirely. The air is drawn through the ozonizers by means of aspirators, which, in turn, draw it into the water in the downflowing stream into a well. From this well it is pumped into the pure water basin. This is the theory of the process, although several modifications have been found advisable. The water rushing into the well is an air compressor of the hydraulic type. This air, under pressure, is then forced through the ozonizers and through another set of aspirators or injectors which carry it into the water in an especially prepared concrete chamber

for ozonization and commingling of the water and air. In the installation in question 4-inch pipes are sunk to a depth of about 30 feet. Into these pipes are inserted small brass tubes connected to the ozonized air chamber. The water rushing down these pipes draws in the air through these small openings and during its fall to the bottom the two materials are mingled. Baffle plates are placed in the upflow pipe to prevent the too rapid separation of the air and water, and at the final egress from this pipe, and with the freeing of the air from the water on settling, the purification is complete.

The ozonizers themselves are comparatively simple in construction. The installation at Lindsay has two ozonizers, consisting of two separate iron boxes, containing twenty-six separate units. Each unit has its own fuse, so that in case of short circuiting the one affected would quietly cease to work with no interference with the remainder. The actual ozonizing mechanism itself consists of a series of plates, connected to alternate currents having a very high voltage. These plates are punched full of small holes with rough edges and the air is drawn over the plates and through the holes in the production of the ozone. The current is obtained from the city mains and goes into the building at about 1040 volts. This voltage is increased by step-up transformers to about 10,000. The two ozonizers are entirely separate and can be operated independently or alone as desired.

The water as it is drawn from the source of supply passes by gravity through a preliminary filter, consisting of a bed of sand three feet thick, into a supply well. This filter is washed out automatically by simply reversing the current and obtaining a supply of water for the purpose from the city mains. This cleansing takes about three minutes on the average and is done daily when the water is very foul. Various arrangements are possible for the operation of the plant. If the water does not require preliminary filtration it can be allowed to flow directly down a well into a subterranean chamber and suck the air If the water power available is at all sufficient the air pressure which rethrough the ozonizers into the water. sults from the separation of the air in the lower chamber will be sufficient to raise the water to a certain height, or the water can be allowed to flow out at a lower level than that of entrance into the well. The air pressure from the subterranean chamber can then be rediverted to the ozonizers, thus increasing the efficiency of their action and producing a complete cycle if desirable. Again, if the hydraulic power is available in addition to the pump, which may or may not be a regular pumping unit, the air, without going through the ozonizers, may be drawn into the current and compressed into the subterranean air chamber. It can then be allowed to go through the ozonizers under pressure and be forced into the water at any point in its further progress and kept there as long as desired. In the particular plant in question the water passes entirely by gravity from the river, through the filter and sterilizing well, to the suction pipe of the pumps. From this the water is forced through the ozonizing chambers and down the 4-inch pipes leading to the bottom of the well. The same pumps can be used for the alternate duty of pumping into the pure water basin through the system and then into the stand-pipe. As can be readily seen, a number of modifications of this type are possible. On egress from the delivery pipe the water is clear, bright and free from disagreeable taste or smell, and is also practically free from noxious germs.

The low first cost of such a plant and the low operating expense puts it within the reach of small communities which have heretofore not considered the installation of an ozone purification plant, because of its high original cost.

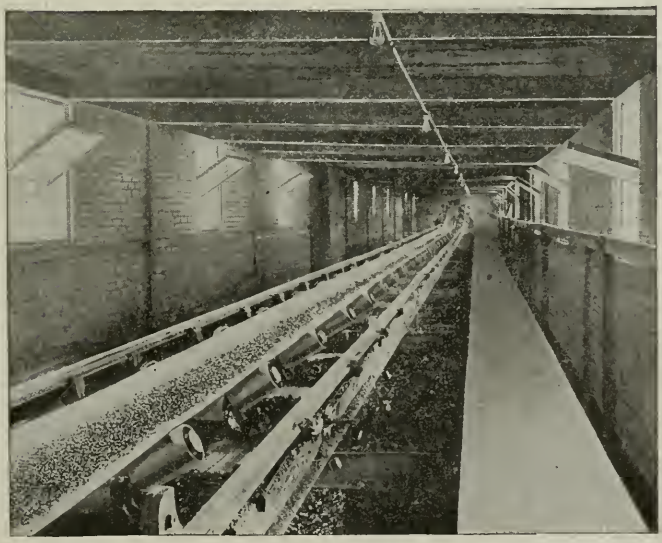
This development is also of special interest to small electric power plants in the installation of electric current in connection with the water works system. Practically no water works plant is too small to install such a system, and while the current consumption is not large, it is absolutely continuous, and a successful working out of the plant at Lindsay would no doubt result in giving an added impetus to the subject.

The above description of the Lindsay plant and its principles was supplied by Joseph H. Hart, Ph. D., contracting engineer, of Cincinnati, O.

The following data regarding the operation of the plant are taken from various reports and indicate that its method of operation is not yet thoroughly standardized:

A test of the purification plant in the summer of 1909 by a bacteriologist of Toronto University showed that the filters removed 75 per cent. of the bacteria in the raw water and the ozone treatment removed 85 per cent. of the

II. HOISTING TOWER WITH GRAB BUCKET AND HOPPER AT THE POWER HOUSE OF THE PEORIA GAS AND ELECTRICAL CO., PEORIA, ILL.



III. BELT CONVEYORS DISCHARGING COAL IN THE STORAGE BINS AT THE POWER PLANT OF THE PEORIA GAS AND ELECTRIC COMPANY

remainder, or a total reduction of 96.2 per cent. A three months' test by the provincial board of health in the winter of 1909-10 showed that by chemical examination no purification was demonstrated, and that the filters removed 30 per cent. of the bacteria in the raw water and the ozone treatment 8 per cent. of the remainder, or 35.6 per cent. reduction in all. The difficulty appeared to be that the ozone produced was not efficiently introduced into the water to be purified, so that it did not have an opportunity to perform its office. Whether this is due to inefficiency in operating the plant or incorrect design does not appear from the report, but the difference between the results of the brief summer and longer winter periods of examination would suggest the former.

Some Problems of Grade-Crossing Elimination

THE elimination of a grade crossing can be secured by elevating the railroad above the street or elevating the street above the railroad, or by elevating one part way and depressing the other the remainder to produce the required clearance.

Elevating the railroad above the street ordinarily requires about 17 feet vertical movement, of which 14 feet is headroom for the street and 3 feet is for the depth of the railroad floor and its supports. Elevating the street above the railroad ordinarily requires 25 to 26 feet of vertical movement, of which 22 feet is headroom for the railroad and 3 or 4 feet is for the depth of the floor system of the highway bridge. A railroad can operate with 16 feet headroom, if absolutely necessary, however. And on the other hand electric interurban railways contend for something like 16 feet headroom for their cars and trolley poles and wire hanging devices. According to the nature of the demands, therefore, the relative economy of the elevation of street or railroad may vary from equality to say 33 per cent saving by elevating the railroad.

Mr. H. J. Pfeifer, engineer of maintenance of way of the Terminal Railroad Association of St. Louis, has made a full statement of the problems to be considered in eleminating grade crossings which is as follows:

(a) Effects of Change in Railroad Grade.

These naturally group themselves under the following heads:

First. Probable increase in maximum gradient and its effect on the efficiency of the road.

Second. Effect on railroad improvements, such as depots, water and fuel stations, interlocking plants, switching yards, etc.

Third. Effect on industrial tracks, buildings and other property adjoining the railroad right-of-way. The last two items are sometimes of serious import as a material change in grade may involve the almost complete destruction of improvements costing large sums of money.

Fourth. Provisions for draining the railroad right-of-way cannot be overlooked and must be given due weight in any plan of grade separation, sometimes at a considerable outlay of money.

Fifth. Damages on account of change in grade on railroad must be paid to anyone who is injured thereby and this item, on account of the amount that may be involved, cannot be passed over without proper consideration.

Sixth. The plan proposed for the crossing under consideration may seriously affect a proper solution for adjoining crossings which makes it necessary at times to consider a series of crossings as a unit. Failure to do this may be disastrous in its results to all concerned.

Seventh. Grade separation on the existing right-of-way may involve so much expense and such unsatisfactory results that a new line, for which right-of-way must be acquired, is the only solution of the difficulty.

Eighth. Due regard must be had for the future development of the railroad and any plan that would seriously hamper it should not be considered.

Ninth. Care must be exercised so that the railroad will have the proper side and vertical clearance along its tracks and any plan in which this is not attained cannot be approved.

(b) Effects of Change in Street Grades.

First. If the grade of the street is changed, a reasonable gradient must

be secured because if it is too steep, great expense and inconvenience result to those using the street. Opinions differ as to what constitutes a reasonable grade, but I believe I am safe in saying that any slope with less than 4 feet rise in a hundred feet comes within that definition.

Second. Abutting damages on account of change of grade on the street are a prolific source of expense in the abolishing of grade crossings and great care should be taken to avoid them as much as possible.

Third. Right-of-way must be acquired for approaches along the street for the highway structure and great skill can be shown in their proper location and design. These last two items frequently amount to as much as the construction cost, and in some cases makes an otherwise acceptable plan prohibitive in cost.

Fourth. Frequently a proper solution requires a new location for the street. This is the case when, for example, it is found desirable to consolidate two streets and make one crossing serve for both. When it is done with discrimination and good judgment, the results are satisfactory to all.

Fifth. A change in the grade of the street forming the crossing may affect other streets in the vicinity and this condition must be given due weight.

Sixth. Most streets have sewers, water pipes, gas pipes and other ducts under them. Relocation or change of grade of these cannot be lightly passed over as work of this kind runs into money rapidly.

Seventh. The same attention to the details of drainage, future development and clearance given to the railroad right-of-way must be accorded the street, because without a proper regard for these features satisfactory results cannot be obtained.

(c) Form of Structure.

The conditions that have just been outlined, refer to the location of the new crossing and the elements that tend to fix it. After this has been determined upon, or rather, while it is being considered, the form of structure to be used must be devised. If the railroad is placed overhead, a structure must be designed of sufficient capacity to take care of the railroad facilities for which it is required. At the same time, ample space must be left underneath to take care of the street traffic in an acceptable and up-to-date manner. A structure for this purpose usually consists of retaining walls along the building lines of the street upon which rests spans, either of steel or some other form of permanent material. The details of construction will vary according to conditions, such as the importance of the street and railroad, the location, whether in a manufacturing or residence district, and the consequent degree of elegance and ornamentation desired in the work. If the street is placed overhead, a structure must be designed of sufficient capacity to take care of the street traffic for which it is required. Ample space should be left below to meet the requirements of the railroad company. A structure for this class of crossings usually consists of two masonry approaches with steel spans of varying length between, to meet the requirements of the railroad underneath. A structure of this kind is also constructed with varying capacities and ornamentation depending on its importance and on the district within which it is located.

(d) We now come to that feature of the grade crossing problem which is the prime factor in preventing and delaying its solution. This feature is not peculiar to grade crossings, but applies with equal force to a great number of the good things of life. We would all have much that we have not, and do many things that we cannot do, were it not for the fact that the cost of acquiring or doing blocked the way. This cost, when grade crossings are involved, is a serious matter because in some cases the expenditure of over a million dollars for one crossing is necessary and in nearly every case in large cities, an average of a hundred thousand dollars or more is required per crossing. The management of even the richest corporation or the most prosperous city may well study and debate before authorizing expenditures of this magnitude. Yet there are many cases when even such expenditures are justified by the results obtained.

The elements that go to make up this cost may be roughly divided as follows:

Preliminary expenses.
Land and other damages.
Grade changes.
Construction.
Interference with traffic.
Maintenance.
Miscellaneous expenses.

(e) The next phase of this question concerns the division of the cost of the work above outlined. I do not believe that this abstract proposition can

well be controverted or denied, namely, that, where an improvement is required that will benefit a number of interests jointly, equity requires that each pay in proportion to the benefit received by it. That being the case, it is unjust to force one of the parties benefited to pay the entire expense. I contend that the city, or state and city, the railroad and the street railroad, if any, using the crossing, should divide the expense on some equitable and just basis: what that is, I am not prepared to say, except that it should be on the basis of percentages of the entire cost of the work and not along the line of each interest paying for certain special items, such as land damages or special features of construction. The work is a unit and the expense entailed should be treated and divided as such. In arriving at a proper basis for the division of an expense of this nature, knowledge of what is done in other places under similar conditions is of value. I therefore made some investigations of what is being done in nontnher states.

The first I turned to was Massachusetts, as that state has always taken advanced ground in such matters, and through long experience has succeeded in establishing a more equitable regulation and control of its corporations than any other state in the Union. Since 1890, under the control of the Board of Railroad Commissioners, a systematic plan for the abolishing of grade crossings has been carried out, so that at the present time this state is freer from dangerous grade crossings than any other.

Up to June 1, 1907, there was spent in that state for the elimination of grade crossings the sum of $29,221,380.86, of which total $17,712,709.95 was paid by the railroads, $7,614,070.28 by the state, $3,856,411.69 by the cities and towns, $38,188.94 by the Metropolitan Park Loan Fund. Or, expressed in percentages, the railroads paid approximately 60 per cent, the state 26 per cent and the cities, towns and Metropolitan Park Fund 14 per cent. And I might add that the state of Massachusetts and the city of Boston at the time that the Boston South Terminal Station was built, contributed towards that enterprise the sum of two million dollars for the construction of retaining walls, viaducts and changes in the locations of adjoining streets.

In the state of New York, the control over the elimination of grade crossings rests with the Board of Railroad Commissioners and the percentages of total cost to be paid by all interests are fixed by legislative enactment as follows:

New railroads—railroad pays 100 per cent.

Existing railroads and new streets—railroad pays 50 per cent; city pays 50 per cent.

Existing crossings—railroad pays 50 per cent; state pays 25 per cent; city pays 25 per cent.

Some years ago in the city of Philadelphia, the Philadelphia and Reading Railroad crossed a number of streets from Broad street to Fairmount Park at grade. As this was in the heart of the city the crossings were found to be extremely troublesome and dangerous. Authority was obtained by the city to place a loan of $6,000,000 for the work with the understanding that the railroad company would reimburse the city for half of the cost, in no event, however, was the railroad company to pay more than $3,000,000. The work was carried out and paid for as planned and has been in use for more than ten years.

The Broadway viaduct in East St. Louis was partially reconstructed at an expense of approximately $60,000, after negotiations extending over a period of a few months only; being just about enough time to put the proposition before all of the interested parties. The expense of this work was divided on the basis of 50 per cent to the railroads, 30 per cent to the city and 20 per cent to the street railway company.

To Mr. Pfeifer's statement of the practice in distributing the cost of eliminating grade crossings may be added the Indiana laws. In Indianapolis, according to these laws, the railroad companies pay 75 per cent of the cost of the separation of grades, the city pays 17 per cent and the county 8 per cent, unless there are street railway tracks, in which case the city pays 14 per cent, the county 6 per cent and the street railway company 5 per cent. Not more than $400,000 can be expended in a year but a contract can be made at one time to cover the expenditures of several years. In cities of the second class the railroads pay 75 per cent of the cost of separation of grades and the city 25 per cent. If there is a street railroad that company pays 10 per cent, which reduces the city's share, with certain limitations as to total amount.

EDITORIAL COMMENT

The Modern Problem of the Road.

Duplication in Activities of Associations.

THE MODERN PROBLEM OF THE ROAD.

There has been an entire change in the statement of the problem of road construction since the advent of the automobile, and sometimes the older forms of traffic have been neglected in making the new formulation of the questions to be answered. Practically, however, the traffic in vehicles drawn by horses has had its full measure of attention. But some of the propositions made to State legislatures regarding legislation have shown too much of the influence of the automobilist, and it is necessary to state more clearly and more frequently the old problem, which is still the most important from the business standpoint, and to make sure that it is not lost sight of in the effort to make improvements for the benefit of the new traffic, which is in the hands of people who know well how to state their case and secure its consideration. When conditions will permit there is no doubt that motor traffic of a more strictly business nature will develop, the development already being fully equal to the opportunities, but there will still remain the animal-drawn vehicle traffic, which must be taken care of.

A discussion of the road problems by experts at a meeting of the Franklin Institute at Philadelphia brings out clearly the demands of the two classes of traffic and the differences in road construction which will result if either class is considered to the exclusion of the other.

The attempt of the road builders of the past has been to make a road surface which will be favorable to the animals driven over it, at the same time that it is durable and as cheap as possible. The earth road when in its state of perfection is the ideal, so far as the animal is concerned, and it is very nearly equal to any other so far as the vehicle is concerned. But heavy travel rapidly turns it to dust; water, beyond light sprinkling, makes mud, and if it remains in the road causes the destruction of the surface, while frost, except in dry climates, very probably makes the road bottomless for a time when it breaks up the soil as it comes out. The best road, when all the above difficulties are considered, has been the macadam road, well drained, well supported so that the soil cannot work to its surface, kept in repair and, where the traffic is heavy, kept sprinkled to lay the dust. This road is harder on the horses, but much less so than pavements, and is better from all the other points of view than the dirt road.

The heavy travel on suburban roads and on through lines and the expense and difficulty of keeping dust down under these conditions have led to many experiments with dust layers, and surface treatments with chemicals, oils and tar have been devised and have been more or less successful. The treatments with heavy asphaltic oils and with tars, especially those refined for the purpose, produce a more durable road, one which is dustless, and, when the best specifications are followed, one which is even more satisfactory to the horses than a plain macadam. Such a road is highly satisfactory for the old traffic and may well be considered the best development in road making if that class of traffic only is to be considered. It would be required only for the main roads and the comparatively slight excess of cost over the common roads could be carried very properly by the State. The county or other authority having the repairs in charge would

benefit from the reduction in that expense.

But this sort of road has been proved by experience to be quite insufficient for the new motor traffic. The reasons for this are very clearly set forth in the discussion above referred to. There was a very good demonstration of the fact at the Indianapolis Motor Speedway last year also. This track was first covered with a bituminous macadam, which was practically the equal of a road which had received the surface treatment referred to. This surface was worn into ruts in every part of the course, and in some places the ruts were worn almost through the layer of tarred macadam. As already stated in MUNICIPAL ENGINEERING, one observer noted that the automobiles on striking a slight inequality in the surface would jump enough to take the weight off of the tires for a distance, which could be computed from an assumed height of obstacle, weight and speed of automobile. During the time of this leap the wheels, relieved of a part of their friction, travel faster than the machine and therefore acted as emery wheels to remove a portion of the surface. This action was so pronounced and the amount of oil used in the first treatment was so small that it was necessary to oil the surface at frequent intervals to keep down the dust raised by the wheels. Where the demands of the race concentrated the traffic the ruts became very serious and the final race was stopped before it was finished. This year the course is covered with a brick pavement, and there has been no such complaint. The new surface has proved to be eminently satisfactory thus far.

The speed of cars exceeded 60 miles an hour frequently. Mr. J. O. Clarke reported, in the discussion above referred to, that there was considerable wear of ordinary macadam roads by automobiles on curves in Valley Forge Park, even when the speed of the machines was restricted to ten miles an hour. He accounts for this by the slip of wheels in turning corners, which is considerable in amount on sharp turns. Open stretches of road which dried out rapidly were also worn by the automobiles, even at the low speed permitted.

Experiences, of which these are exaggerated examples, have led the English to consider special roads built for automobile traffic alone, and have led some counties in Ohio, notably Cuyahoga county, in which Cleveland is situated, to build narrow paved brick roads on one side of the highway, parallel to an earth or gravel or macadam roadway. The horse traffic in good weather prefers the softer road, leaving the brick roadway to automobiles, but can use the harder surface in bad weather or to get around stretches in bad repair.

This is one method of solution of the question and supplies two kinds of road to keep up—the soft road, which must be kept in condition for traffic in good weather, at least, and the hard road, which, if well made of good material, should require but little attention, if mainly used by automobiles, for their soft tires have little or no effect upon it.

Another method of meeting the difficulties which has several points of advantage, is that of making a roadway which will be satisfactory for both kinds of traffic and which must be used by the two in common. The discussion above referred to seems to lead to the conclusion that, at this stage of development at least, the roadway answering these demands best is made by mixing broken stone and prepared tar or other equally good bituminous material according to one of several excellent specifications and laying the mixture in a compacted layer on a properly prepared and drained sub-grade.

Some of the advantages and disadvantages of both methods may be stated to show the nature of the investigation which should be made before any particular system is chosen for use in a given locality or state.

As to cost not much can be said, as the difference between the two methods depends so much upon details that it must be worked out for the particular conditions. Unless one is willing to endure the dust nuisance, it will be

necessary at least to oil the soft roadway alongside the brick pavement so that the dust will not fly in dry weather. For a very heavily traveled road it may well happen that a bituminous macadam roadway of sufficient width would cost as much as a narrow brick pavement and an oiled road alongside, and the brick pavement would be more durable and therefore better, while in other cases the higher cost of the brick pavement would put it out of the consideration.

A brick automobile way would permit rapid travel in good weather with little interference with the slower traffic. The speed might be limited only by the danger in turning corners. The experience with the old Indianapolis Speedway suggests the desirability of limiting the speed on a bituminous macadam highway, even if built much more substantially than that course was built. Then, too, the joint use of the roadway by motor and horse vehicles demands slower speed, at least when the two are on the same stretch of road.

The brick pavement is the only pavement which does not deteriorate when standing without use or with very little use. If not properly laid it may be affected by expansion and contraction more than a bituminous macadam, but it will not change its nature or composition under the action of the weather. Washouts would probably affect the one as much as the other.

The two classes of roadway are developing at the same time, and, in Ohio, almost side by side, so that practical experience will soon give data for a comparison of results.

A more detailed account of the Cuyahoga county, Ohio, brick roads, which the writer has recently inspected, will be given later.

DUPLICATION IN ACTIVITIES OF ASSOCIATIONS.

As a member of the committee on standard specifications of the American Society of Municipal Improvements the writer has had an opportunity during the past month to make some observations on the difficulties which may arise and the waste of effort which may occur on account of duplication of societies in the same field. The above named committee, together with the committee on brick pavements of the Organization for Standardizing Paving Specifications, were the guests of the National Paving Brick Manufacturers' Association on a trip of inspection of brick pavements, good, bad and indifferent, in various Indiana and Ohio cities. Several of those present were members of both organizations, and there was the greatest of harmony among the members of the committees, but nevertheless each committee had its own point of view, its own program of procedure and its own method of arriving at a report. While each is willing to accept the results of the labors of the other, in the intervals between their accidental opportunities for consultation they must proceed independently, and consequently, so far as their fields coincide, with inevitable duplication and possible conflict in ultimate reports, because they act upon different and incomplete information, viewed from different standpoints. This will be still more evident in the work of the sub-committees of the first of the above named societies, which will be appointed to take up the details of the various branches of the work.

If these tendencies are seen under complete harmony of action, how much more evident would they be if antagonisms should arise which would involve the two main organizations. How much more economical of time and effort would it be to thrash out, in the comparative privacy of the committee and association meetings, the differences of opinion which will arise, so that the resulting reports or specifications, when published, will go out with the authority of the united organization. How much more effective will be the campaign of education of city officials and citizens which the labors of these organizations are intended to further, if the engineers agree in principles and as far down the list of details as possible before the reports go to the public.

The younger organization named was called together by the city of Chicago with the primary object of getting together information which the engineers of that city could use as a basis for improvements in its specifications for construction work, and those brought together were so energetic and were so eager in their search for the same information that they joined in the work with enthusiasm.

As already stated, many of those present were also members of the American Society of Municipal Improvements, and it should be easy for them to make the combination which is really necessary if the best interests of the municipal officials engaged in the work of public improvement are to be served.

The new organization was formed for a special purpose and found itself unable to reach its objective point in one convention, claiming that its work thus far is merely preliminary. The second convention will do much to reduce to reasonably permanent form many specifications concerning which there is little or no controversy. It will not, because it can not, take final action upon anything, for future changes in condition will demand future changes, but it will leave open to controversy only details upon which it has been impossible to crystallize practice and upon many of which it will always be impossible to agree.

Really, the Organization for Standardizing Paving Specifications is devoting itself to a field which is covered by a few sub-committees of one of the standing committees of the older organization, and its energy would give the latter needed new life, at the same time that it would itself gain authority by making use of the stability and established position of its elder.

Of the making of new societies there is no end, and when there is complete duplication of field there can be no doubt of the error in the formation of a new one. There can be no question of the desirability of such conferences as that which resulted in the new "Organization, etc.," nor of the second conference called for next January, but that does not justify a new permanent society. Either the new one must expand to fill the field and crowd out the older, must fade away, or be absorbed. There is not room for both.

There is sufficient differentiation between the aims and membership of such societies, for example, as the National Municipal League, the League of American Municipalities, and the American Society of Municipal Improvements, to give some show of justification for their continued separate existence, although they would all be benefited by some closer affiliation than they have at present, but the new organization draws directly from the field of the last of the three, and there is too small a pasture for both. One or both will starve if they try to divide it.

THE QUESTION DEPARTMENT

Cost of Asphalt and Bitulithic Pavements.

Will you please send me the probable costs of paving by the square yard for asphalt pavement and bitulithic pavement. and oblige,

E., ————, Ind.

The cost of asphalt pavements, as determined from recent reports of construction, varies from $1.65 in Kansas City, Mo., to $3.57 in Lorain, O. The cost in Indiana towns varies from $2.13 in Columbus to $2.64 in Auburn. In most of the cases included in the data before the writer the cost per square yard was obtained by dividing the total cost of the street by the total area in yards and includes all items of cost from grading to guarantee. The average cost in about 50 cities is $2.50 a square yard and in four Indiana cities is $2.40, and the cost in the city from which the inquiry comes will approximate very closely these averages. The cost of bitulithic in a dozen cities where reports are at hand varies from $1.48 in Ann Arbor, Mich., to $2.67 in Dallas, Tex., and averages about $2.25. In three cities out of five which have both pavements bitulithic brought the higher price and the average costs for the two pavements reverse the average given above for costs in all the cities reported.

It may be said, therefore, that the average cost of both bitulithic and asphalt for this city will probably be in the vicinity of $2.25 to $2.50 a square yard and that local conditions will probably determine which is the less expensive.

Concrete Blocks for Monument.

I would like opinion as to whether a creditable and enduring monument can be constructed of cement or cement blocks, and as to where we can get plans or cuts of same, the whole cost not to exceed $250. Any information along this line will be greatly appreciated. The monument will be for a soldiers' cemetery and of a general nature, with a tablet of marble or granite for lettering.

D. C. N., Charlevoix, Mich.

Monuments can be made of concrete as durable and probably as handsome as of any other material. Two things are essential: first, an artistic design, made with the express purpose of constructing the monument of concrete in place or of concrete blocks, as may be chosen, and second, first-class, expert workmanship. The monument will not be cheap if these two requisites are met, but it will probably be materially cheaper than a stone monument of equally good design and construction. The monument or the blocks should be made of as wet concrete as possible, such as is used in making so-called cast stone, and special materials should be used on the surface so that when the surface is finished by one of the good methods of making artistic surfaces the material showing after the surface cement has been removed will add to the artistic effect. The book on "How to Use Concrete" ($1) contains instructions for making blocks for making monuments, for making forms for molding ornamental concrete work, etc. This book is written for the cement worker and if one follows its directions without previous experience in the work and without special practice in artistic surface finishes the results may not be entirely satisfactory. A little book on "Practical Concrete Block Making" (50 cents) gives instruction on how to make the blocks for such a monument after they are designed. Houghton's "Ornamental Concrete Without Molds" ($2) and his "Concrete from Sand Molds" ($2) are brief treatises on two other methods of making monuments and blocks with which to build them. The latter gives the method of making cast stone.

Oiling vs. Sprinkling Brick Pavement.

Lebanon has no water system, so we are barred to a certain extent from sprinkling our streets. We have quite a nice and very substantial piece of vitrified brick paved street. The joints are bound and slushed with cement. The brick are very permanent and firm. Some of our business men want to lay the dust by the use of oil. I was afraid it might be detrimental to the road by causing the cement to eventually let loose of the brick. Jas. S. Gedney, Mayor,

Lebanon, Ill.

The writer has had no personal experience with this method of keeping down the dust on brick streets. Mineral oils have little or no effect upon concrete, so that it is probable that sprinkling the street with oil would have no objectionable effect upon the structure of the pavement. The queries arise as to whether the odor from the oil will not be as objectionable as the dust, and also as to whether the oily dust will not be a serious nuisance, because it will be thrown by wheels and will stick to shoes and be tracked into stores and houses. The oil will evaporate and must be replaced fre-

quently, so that the process will be rather expensive.

The Studebaker Brothers Manufacturing Co., South Bend, Ind., make a machine for cleaning streets which is easily adapted to sprinkling streets where there is no water supply. It consists of a sprinkler tank on wheels and a gasoline engine driving a pump, which pumps water from the tank and flushes the street by properly directed streams under the pressure produced by the pump. Connections can easily be made so that a suction pipe from the pump can be dropped into a well, cistern or pond and the pump used to fill the tank. The pump can then be used according to the original design of the machine to flush the street, cleaning it at the same time that it is wet down, or an ordinary sprinkling attachment can be put on the tank and be used in the usual way, the only function of the pump in the latter case being to fill the tank. This promises better results than the sprinkling with oil and probably at less expense.

Calcium chloride treatment has been suggested as reducing the number of sprinklings necessary, though not eliminating them entirely.

Can our readers make any suggestions from their experience which will be of interest to our correspondent and to many water carrying some fine material and others in the same condition?

Great Lakes Portland Cement Co.

Can you give me any further information about the Great Lakes Portland Cement Co., which is given in the "Directory of American Cement Industries" as having been formed to purchase the Great Northern Portland cement plant at Marlboro and move it to Charlevoix, Mich?

SUBSCRIBER, ————, Minn.

It is understood that the company referred to is now inactive and letters sent to it are not answered. There is another Great Lakes Portland Cement Co., whose home offices are in St. Louis, and sales office in Chicago, which has been capitalized at $1,500,000 and proposes to build a plant in northern Michigan, but it has no connection with the former company of the same name.

Books on Oil Refining.

Kindly advise where I could obtain technical books pertaining to oil refining.

R. F. S., San Francisco, Cal.

The following are the books on the subject: "Mineral Oils and Their Products," by I. I. Redwood ($6); "Petroleum," a comprehensive treatise by Redwood and Holloway ($13.50); "Petroleum Distillation and Modes of Testing Hydro-Carbons," by A. N. Leet ($2 net); "Destructive Distillation," by E. J. Mills ($2). These books can be supplied by MUNICIPAL ENGINEERING Co. at the prices named.

Re-Design of Supply Main for Larger Water Supply.

A water system having a mile of six-inch pipe on a grade very free from curves and sags, with one hundred fifty feet fall in that mile and a mile of same sized pipe, with twenty feet fall, passing under two rivers, with an eighteen-foot depression under the beds of rivers, desires to obtain a larger flow of water. Should they lay larger sized pipe on the grade commencing at the reservoir, or should they commence at the foot of the grade and lay under the rivers?

Also should they lay pipe on curves or on right angles where they turn corners, and at these corners will it help the flow to use pipe two or four inches larger in diameter for a few lengths of pipe?

WATER WORKS Co., ————, N. Y.

Only a general answer can be given without personal knowledge of all the conditions. To give some idea of the method of computing the problem it may be assumed that a 6-inch pipe 5,000 feet long has a total head at its outlet of 150 feet, and the free discharge from the open end of that pipe would be given by hydraulic diagrams as about 580 gallons a minute. If a 6-inch pipe is assumed with 170 feet total head and 10,000 feet length, the same diagram gives about 420 gallons a minute flow, or a reduction in capacity of nearly 30 per cent. If, now, the first 5,000 feet is assumed to be of 6-inch pipe with a total head of 150 feet and the second 5,000 feet is assumed to be of 8-inch pipe with an additional head of 20 feet, the discharge at the end of the 8-inch pipe would be about 550 gallons a minute, or a reduction in capacity from the first mile of 6-inch pipe of about 5 per cent. A 10-inch pipe on the second mile would have greater capacity than the 6-inch pipe on the first mile. These figures are only for illustration and do not represent the actual state of the case as it would be worked out, because they do not take into account the pressure at which the water must be delivered, any pressure which may come from head of water in the reservoir, the effect of any rises in the pipe above the hydraulic grade line or the draft of water from the main line by branches along the way.

The proper way to attack the problem is to determine the maximum rate at which water is to be delivered, making due allowance for increase in quantity required, the maximum pressure at which it must be delivered, the head at each critical point and the probable losses of head and their location. Then the sizes of pipe can be computed and a proper solution of the problem can be made. Probably the 6-inch pipe was laid without proper attention to the problem in the first place, and it would be well to do any new construction according to a proper plan, even if it is not all done at once. If the water is intended to serve for fire protection a 6-inch supply main gives unsatisfactory service, especially

when of such length as the one under consideration.

Changes in direction of pipe lines should be made in curves, but these curves should be short. Exhaustive experiments indicate that the radius of the curve should be not less than 2½ diameters of the pipe, but should not be much more, say 15 to 18 inches for a 6-inch pipe. Increase in size of pipe at turns would introduce a source of disturbance of flow which would probably produce more obstruction than the plain curve in the 6-inch pipe.

Street Cleaning by Vacuum Process.

As a student of municipal highways affairs, I wish to suggest to your many readers interested in these matters the desirability of cleaning city streets by the vacuum process. No move in this direction has come to my attention to date, but the thing seems to me eminently practical. No doubt large power trucks equipped with suitable mechanism can be designed, and the benefits to be derived from this method of cleaning are many; readily suggesting themselves to any engineer.

Our present methods of sweeping the streets are very expensive, are never successful in gathering the very small particles of trash that are so unpleasant on a windy day, and create a dust in process that is decidedly unpleasant to passersby. An automobile cleaner truck could gather up a full load of the dirt of the streets, haul same to a depot, and be back at work on the streets in a very short period of time.

Trusting that you will call this to the attention of your readers so that some genius of mechanisms may work out an apparatus that will be a real benefit to all city dwelling mankind, I beg to remain, C. A. M., New York City.

The first and long the only street cleaning apparatus using the vacuum process was invented by R. W. Furnas of Indianapolis, Ind., about fifteen years ago. Brief descriptions of its action will be found in MUNICIPAL ENGINEERING, vol. viii, p. 270, and vol. x, p. 131. It covered the ground so completely that there has been no further development until recently. It is understood that a new design of the machine which is automobile, has recently been made and that it will be even more satisfactory than the excellent machine heretofore constructed by Mr. Furnas's company.

Such a machine is in process of development at Muncie, Ind., but is not yet ready for the market. Two patents have recently been granted on machines which do the sweeping by brushes and use an induced current of air or a fan to handle the dust from conveyors from the brushes. One of these, 880,124, was issued to C. H. Butler, Oakland, Cal., and one, 892,260, to Henry A. Huber, Winnipeg, Man.

Mr. Furnas's machine depends on the suction of air by a fan, entirely and is very satisfactory both as a thorough cleaner and as a dust preventer during the process of cleaning.

Assessment of Sewer Costs.

Can you tell me where I can get information regarding the assessment of sewer costs in small towns?

C. D. W., ————, Wash.

A full discussion of the question is given in the March number of MUNICIPAL ENGINEERING, vol. xxxiii, page 191.

Other articles having a bearing on the same question will be found as follows: Vol. ix, p. 242; vol. xii, pp. 105, 154, 184, 372; vol. xiii, pp. 154, 372; vol. xiv, pp. 38, 313; vol. xv, pp. 315, 322; vol. xvii, pp. 32, 33, 97; vol. xviii, pp. 73, 347, 252; vol. xxi, pp. 82, 174; vol. xxiii, p. 168; vol. xxv, pp. 257, 380.

Machinery for Ozonizing Water.

We have received a letter from a firm in St. Petersburg, asking for the names of manufacturers of machinery for ozonizing water. We do not know of any manufacturers of apparatus of this nature, but it occurred to us that you may have some information on the subject, and if so we would greatly appreciate any information that you may give us.

G. C. G., Philadelphia, Pa.

There are several systems of applying ozone to the purification of water and sewage. The de Frise system is in use at St. Maur, Paris, the main office of M. C. de Frise being at 38 Rue du Louvre, Paris. The Vosmaer system is in use in Holland and has been tried with rather indifferent results in America by the United Water Improvement Co., Philadelphia, Pa., which has displaced it by designs made by J. H. Bridge, and has installed several of the Bridge plants. The Siemens system is in use in Germany, installations being made by the Siemens-Halske Co. of Berlin. They have also put in some plants in other countries through their various branches.

The Otto system has been installed in Nice, France, by the Lahmeyer Electrical Co. of London, W. C., England. The Gerard system is developed in America for the Gerard Ozone Process Co. by Westinghouse, Church, Kerr & Co. of New York City. The Steynis system has been built for a private house by the Steynis Ozone Co., 30 Pine street, New York City.

Can Ohio Cities Do Their Own Construction Work?

I would deem it a great favor if you would answer the following questions: Is it possible under the Ohio Code for a city to do its own construction work in cost over $500? and if so, what cities, either in Ohio or other States, are doing so?

S., City Engineer, ————, O.

This is a question for the city attorney, who is presumably familiar with the laws governing his city. Sec. 143 of the Ohio "Municipal Code," passed in 1902, prohibits doing of work or letting of contracts amounting to more than $500 without authorization by the city council, and prescribes that contracts

shall then be let by the proper board or other authority, but gives the city departments no authority to do their own construction work. The writer has no knowledge of any amendment to this section. Numerous cities do more or less work on their own account. Columbus, O., operates it own asphalt repair plant, presumably by special authority. Indianapolis, Ind., cleans its own streets and repairs them, also running its own asphalt plant. Nashville, Tenn., builds its own bitulithic streets. Detroit builds its own asphalt streets, etc.

How to Make Pipe Line Water Tight.

A 6-inch tile water line imbedded in concrete 12 inches by 12 inches was supposed to hold water, but by using coarse material in the construction of the concrete beam the line leaks through the joints and seeps through the concrete. This line was not supposed to be watertight, but was intended to retain water in the line at least half full for 15 minutes. It is now entirely covered and I would like to know if there is any way of treating the inside of the pipe by using swabs with tar or some other material to close up the joints of the pipe. The line is 100 feet long and is open at both ends.

P., ———, Pa.

Can our readers make any suggestions?

It would seem that the swabbing with tar would be sufficient if it were thoroughly done, especially since the lower half of the pipe only is to carry water. Another suggestion is filling the pipe with keeping it so until the seepage of water has carried the fine material into the voids in the concrete surrounding the joints and into the joints themselves. For temporary work corn meal or some such substance has been used, but its organic nature would indicate that it would serve a temporary purpose only. Finely divided clay, chalk or perhaps cement ought to be successful if the line can be thrown out of use long enough to produce the effect.

Is the Long Compass Needle the Most Sensitive?

I note in the article by Charles Lyman Wood, "The Young Engineer and His Working Tools," the statement that a 4½-inch needle is more sensitive than a 6-inch. Is this true? If so, what is the value of the larger needle? I am in the market for transit and want to be guided in selecting the best.

H. A. Morrill, ———, Neb.

Gurley's "Manual" (50 cents) states that "the test of the delicacy of a magnetic needle is the number of horizontal vibrations which it will make in a certain arc before coming to rest; besides this, most surveyors prefer to see also a quivering motion. This quality, which is manifested more in a horizontal than in a vertical needle, depends upon the near coincidence of the point of suspension with the center of gravity of the needle, and merely serves to show that the cap is unobstructed."

Staley's Gillespie's "Surveying" ($3.50) says that "the principal requisites of a compass-needle are intensity of directive force and susceptibility. Beyond a certain limit, say five inches, no additional power is gained by increasing the length of the needle. On the contrary, longer ones are apt to have their strength diminished by several consecutive poles being formed. Short needles, made very hard, are therefore to be preferred. The needle should not come to rest very quickly. If it does it indicates either that it is weakly magnetized or that the friction on the pivot is great. Its sensitiveness is indicated by the number of vibrations which it makes in a small space before coming to rest." Similar statements are made in Phillips's "Plane Surveying" ($1.50).

The advantage of a long needle is in the increase in space between graduation marks, permitting increase in their number and in the minuteness of vernier readings, but the accuracy of the needle is not sufficient to warrant great refinement in this direction, so that the above named books are justified in their choice of five inches as the maximum length of needle.

Books on Public Parks.

Have you among your publications any work on public parks?

A. S. T., Astoria, Ore.

The following are books on landscape gardening which may contain information applicable to the case:

Repton's "The Art of Landscape Gardening" ($3.22), a new edition, edited by John Nolen.

Parsons' "Landscape Gardening" ($2).

Maynard's "Landscape Gardening" ($1.50).

Lowell's "American Gardens" ($7.50).

Kellaway's "How to Lay Out Suburban Home Grounds" ($2).

Ferre's "American Estates and Gardens" ($10).

Hansen's "What Is a Kindergarten?" ($1.00).

Mero's "American Playgrounds" ($1.70).

The following articles in Municipal Engineering have bearing on the same subject:

"The Care and Maintenance of Public Parks," vol. xxxiii, page 305.

"Street Openings, New Parks and Boulevards," vol. xxxiii, page 408.

Who Makes Scott Valves?

In response to the inquiry made in Municipal Engineering, vol. xxxix, p. 36, Jas. F. Brook, C. E., Palestine, Tex., states that the Roe Stephens Manufacturing Co., Detroit, Mich., will on request send catalog of the Scott valves desired.

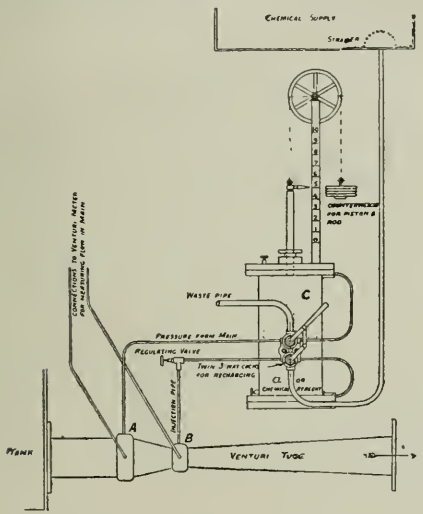
Automatic Regulation of Chemicals with Flow of Liquid.

Is there any apparatus in use for the automatic regulation of the flow of a chemical solution for treating water or sewage so that the flow of the chemical will be proportioned to the flow of the liquid to be treated and will not require constant personal attention?

J., ————, Ind.

The following description of a design for such apparatus made in England is given in a recent number of *Surveying and the Civil Engineer,* published in London:

The apparatus consists of a cylinder C, the top of which is connected by means of a pipe fitted with a three-way cock to the "upstream" end of tube A. A similar connection is made from the bottom of the cylinder to the "throat" B. A piston of the type used in the Kent standard water meters and provided with a



counter-balance weight, works in the cylinder by means of the difference of the pressure on the two sides of the Venturi tube. The chemical solution (e. g., a 5 per cent. solution of chlorine) is supplied to the under side of the piston and the pressure on the upper side of the piston being greater than the pressure on the under side, the chemical is forced down by the piston and injected through the injection tube and regulating valve into the effluent at the "throat" of the Venturi tube. As the flow of the effluent through the Venturi tube produces a difference of pressure which varies as the square root of the velocity, the rate of injection will also vary in the same proportion. The injection is thus in exact proportion to the flow, and any variation of the flow will automatically cause a corresponding variation in the rate of injection.

When the chemical re-agent is exhausted the piston will be at the bottom of the cylinder and the pointer at zero. In order to recharge the cylinder with the chemical the three-way cocks must be reversed by means of the hand-lever, thereby cutting off pipes A and B, and simultaneously connecting the top of the cylinder to the waste pipe, and the bottom to the supply from the chemical storage tank, which is fixed at such a height that the head will rapidly force the piston up and refill the cylinder with the chemical. The three-way valves are then reversed and the apparatus is again in full working order. The apparatus shown is applicable to the treatment of 1,000 gallons per hour, and will only need recharging once per day of twenty-four hours.

A feature of this apparatus is that it is self-starting, and should the flow cease the injection will also automatically stop, the static head on both sides of the piston being equal. There is absolute immunity from danger or over-injection of the chemical by this system, and this is a valuable factor in the treatment of potable water. By means of the indicator the works manager is constantly informed of the exact amount of chemical injected, and the scale readings can be compared with those of a Venturi meter operated by the same Venturi tube. This apparatus can be supplied of a larger size and provided with automatic recharging gear for larger installations.

Use of Sewage for Irrigation at Fresno, Cal.

In connection with the article in the Question Department of the July number, vol. xxxix, p. 38, regarding the disposal of sewage by irrigation, the following regarding the plant at Fresno, Cal., will be of interest as showing the necessity of care in the application of sewage to prevent nuisance. The description is taken from an article by Robert H. Ellithorpe, the inspector of plumbing in Fresno, which appears in *Public Works.*

I will endeavor to describe some of the conditions existing in the system of our sewers in Fresno, Cal., a few years ago and how they are today. Fresno has a population of about 30,000, is the geographical center of the State of California and is situated 209 miles southeast of San Francisco, in the San Joaquin River valley. We have surrounding us a large productive country devoted to fruit-growing and the raising of vegetables and alfalfa. In our country of little rain (so necessary to the proper curing of our crops) we resort to irrigation and give the plant life water whenever it needs it.

Previous to January, 1908, our outfall sewer used to dump the raw material on a ranch about seven miles southwest of the city, the owner of which was paid $150 per month for taking care of it. He used what he wanted for irrigation and left the rest to find a level at any old place it could in his pasture. The condition became so bad that the people in this vicinity united and brought suit against the city for maintaining a nuisance, and proved their case, which was settled by the city putting in the present disposal plant as a part of the present sewer system. Water for irrigation is of great value in the San Joaquin valley, and the water from our sewers is of as much value as its fertilizing qualities. The amount of water flowing to our sewer farm is about 5,032,271 gallons per day.

The utilization of this sewage for the purpose of irrigation without becoming a nuisance governed Mr. Geo. L. Hoxie, the city engineer, in the preparation of the plans of our septic tanks and sewer farm.

A tract of 812 acres of land was purchased and the old outfall extended to it,

and a second 14-inch vitrified outfall was built to provide for the increase in flow from the system.

The outfall is on a grade of 3.3 feet to the mile, and terminates in a redwood box sewer, 2 feet by 4 feet, that extends for 3,100 feet across the farm property. From this box the sewage goes through the oil traps. A considerable amount of oil accidentally is allowed to escape into the sewers from the railroad roundhouses, lighting plant and canneries, etc., and it is removed at this point in the system. As much as two barrels have been caught in a day, but this amount is unusual. The trap is 10 feet by 10 feet by 6 feet. From this point the sewage runs along the side of the tank about 80 feet, where it enters the grit chamber, which is 4 feet by 5 feet by 4 feet, and extends from one side of the tank to the other, with a gate at the far side for the purpose of cleansing the chamber. When cleansing this part the sewage runs in an open ditch a short distance to a cross ditch, from which it is distributed onto a sand filter-bed that is sub-drained. This chamber is cleaned twice a week. On each side of the grit chamber are four tanks, 36 feet by 90 feet by 8 feet, built of brick, laid in cement. Each compartment is covered by a roof to exclude light, with a ventilator over each, also one over the grit chamber. The whole tank covers a space 150 feet by 200 feet.

The sewage enters each compartment through three 8-inch by 10-inch Y's, set upright on the floor so as to maintain a depth of 2 feet in the grit chamber, the 8-inch branch extending through the wall to within 1 foot 6 inches of the bottom of the tank. The outlet of each compartment consists of three L-shaped 8-inch pipes, extending to within 2 feet of the bottom, in order to draw off the liquid between the sludge on the bottom and the matt on the top. There is also a flush-gate at the bottom of each compartment for the removal of sludge.

Any tank can be taken out of commission by placing taper plugs or sleeves in the three 10-inch Y's, thus preventing the flow entering this compartment. The outlet pipes discharge over an aerating weir into a box drain along each end of the tanks, from which it is carried to main ditch and distributed about the farm.

At the present time the farm is under municipal supervision, Geo. L. Hoxie, city engineer, having general supervision; B. E. Cronkite, assistant city engineer, being in direct charge.

Last year 240 acres were planted with vines and a like number of acres will be planted with alfalfa and vines this year, and possibly a small tract to eucalyptus trees. This, however, is not considered the best crop for the disposal of sewage, as the trees exclude sunlight and lessen evaporation.

The best crop for this purpose in Fresno is alfalfa, the sewage being applied after each cutting, of which there are five.

Saving Through Owning Concrete Mixers.

Figures compiled from the books of the Aberthaw Construction Company, Boston, Mass., who run ledger accounts for each concrete mixer, showed a saving of about 18 per cent. on the plant cost per yard of material mixed by owning mixers instead of renting them. The mixers in question had been owned from three to seven years and had mixed from 10,000 to 20,000 yards each.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

A Little Bituminous Filler Story.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Three years ago the Department of Public Works of Little Rock decided to make an attempt to avoid the unsightly, wide transverse expansion joint in brick paved streets and to provide, at the same time, for more expansion. We confess we were prejudiced against bituminous fillers and in favor of cement grout. But we have always favored plenty of expansion joints to counteract the cement grout.

On a little district which was being paved by subscription and upon which not enough money could be raised to do a first-class piece of work, the experiment was tried. In the first place the brick were not high grade. They would not stand the National Brick Makers' rattler tests, nor would they stand the absorption test. But they were purchased at a very low figure and we expected the grouting to do the rest.

The pavement was laid on a four-inch concrete foundation, and under the usual specifications. A first-class job of work was done by the contractor and his ce-

ment grout was as well done as is usual on the ordinary brick job.

For the transverse expansion joint, however, we spaced our brick to give one and one-half inches for every one hundred feet in length of street. This made a pretty wide expansion joint, but this amount was deemed necessary on account of the quality of the brick.

The 12-inch strips were placed in the street as the brick were laid, but before pouring the hot filler into this wide joint the three rows of brick either side of the strip were moved inward after the strip was removed, making seven narrow joints to be filled instead of one wide one.

This method has proven a success. It has allowed plenty of expansion and at the same time it has not left a wide, unsightly joint for the bituminous material to expand and contract in, leaving the edges of the border brick unprotected.

But the most valuable lesson taught has been the protection which a bituminous filled affords the brick. The grout filler was well applied and was of good consistency. But as stated the brick were not "number ones." Consequently there has been an excessive abrasion, due to the heavy traffic carried by this small section of street. After three years the brick which have been filled with grout have worn down very considerably, brick and grout together, leaving, however, a fairly smooth street. But every one hundred feet there is a slight ridge in the street from curb to curb. Where the brick have been spread and the bituminous filler used the brick are in almost as good condition as when they were laid, showing very little wear due to the three years' traffic.

A short time since the writer had the privilege of showing representatives of two large bituminous filler concerns over this work and both were astonished (and of course elated) at what they saw. And as strong as our prejudice was against bituminous filler, we must confess that we have seen with our own eyes that where a cement grout has failed to save a soft brick used for paving purposes, the bituminous filler has, after three years' constant wear, so protected the same brick, under the same conditions, that it shows practically no wear. It has been to us an interesting and valuable lesson and we have watched it carefully for a long time. It is given to our fellow engineers now after three years' test that they may, if they choose, profit by our own experience, as we are doing from time to time from experiences of others.

E. A. KINGSLEY, City Engineer,
Little Rock, Ark.

Tanks of Reinforced Concrete.

At Saventhem, Belgium, is a reservoir holding 100,000 gallons of water on eight pillars fifty-five feet high, built of reinforced concrete on the Hennebique system. The foundation is a reinforced concrete ring acting as a unit. The pilars of the tower are joined by reinforced concrete beams, so that it acts as a unit. The slabs, three bays in each space between pillars, are filled in with brick curtain walls with windows in each alternate triplet of bays and a door at the base of one, thus giving plenty of light to the interior of the tower.

At the base of the reservoir is a truncated cone twenty-three feet in diameter at the bottom and thirty-three feet at the top and five feet high. Above this the reservoir is cylindrical, thirty-three feet in diameter and fourteen and one-half feet high. Up through the center of the whole structure extends a cylindrical tower eight feet in exterior diameter, in which are located a winding stairway and the inlet and outlet pipes of the reservoir. This tower extends above the reservoir top, has an ornamental top and opens on an ornamental platform forming part of the cover of the reservoir. The platform is surrounded by a reinforced concrete railing. The decorations are very quiet, but have been carefully studied and their effect is distinctly more pleasing than has been usual in structures of this sort.

Grooved Wooden Block Pavement on Steep Grade.

A portion of James street, Hamilton, Ont., was paved last year with creosoted wooden blocks. On account of the grade these blocks were grooved. The grade is 6 per cent. and is at the head of the main street in the city just before it reaches a high bluff and incline railway. There is a large amount of traffic over this street from two different roads besides the incline railway.

The blocks are laid at right angles to the center line of the street, each block having a groove ½-in. wide and 1-in. deep, the groove being laid at right angles to the center line of the street. The wooden blocks were laid on the flat grade approaching with cement grout, but on the grade asphalt filler was adopted. The crown was laid very flat, rising only about 2-in. in the center. After the first few weeks, when the surplus asphalt filler had been worn off, there were no complaints whatever about the slipperiness of this pavement, and heavily loaded teams go up and down without any difficulty, as the grooves give the caulks of the horses' shoes a firm foothold. The previous pavement was an ordinary macadam, but on account of the amount of water coming down the street from freshets or heavy rainfalls it was unsatisfactory. Mr. Andrew F. Macallum, city engineer, states that since the wooden blocks have been laid they have had no trouble in any way.

Forms of Water Bills—Water Rates.

To the Editor of MUNICIPAL ENGINEERING:

Sir—We notice that you are publishing copies of forms for water rent bill in MUNICIPAL ENGINEERING.

Same should be appreciated by water departments, as we are all looking for information which will enable to lessen our work and keep our records in an up-to-date manner. I enclose copy of form of bill which we are using for flat rate consumers; also copy of our inspectors' card and register sheet which we have found quite convenient. We find that it would have been better to have the street number come first and the name last on the register card and the name first and the street last on the inspectors' card, as in making inspection same is made by streets, while bills are kept alphabetically.

We also enclose a comparative table of water rates which we compiled a few years ago. It will give an approximate idea of the flat rates which are being charged in some of the cities and towns of Connecticut.

S. H. MCKENZIE, Supt.

Southington Water Co., Southington, Conn.

SOUTHINGTON WATER WORKS—Inspectors Card.

Name Ellen V. Ball. No. Marion Ave. Ave.

John C. Moore Corporation, Rochester, N. Y. Binder and holes in leaves each Patented 1906 01731

Service No. / Date Inspected	Families	No. Persons	Kitchen Faucets	Hot Water Boiler	Water Closets	Bath Tubs	Set Bowls	Set Tubs	Hose Connections	Barn Faucets	Horses	Cows	Bar Faucets	Beer Pumps	Urinals	Public Closets	Public Bath Tubs	REMARKS
3/16/87																		
House	2	5	3	1	1	1	1		1									Closet out of Repair.
Stable																		
Store																		
Office																		
Barber Shop																		
Drug Store																		
Saloons																		
Factory																		

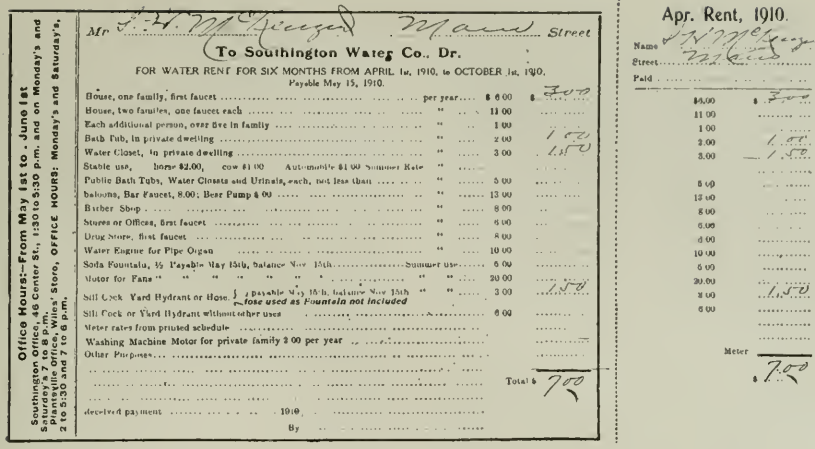
REGISTER-SOUTHINGTON WATER WORKS

No. Street Name

Remarks

Service No. Size Date. Transfers { From Date / To Date

Date of Additions	No.			
		Dwelling, one family, 1st faucet	Per year	6.00 Semi-Annual Rate
		" two families, one faucet each	" "	11.00 " " "
		Each additional person, over five in family	" "	1.00 " " "
		Bath Tub, in private dwelling	" "	2.00 " " "
		Water Closet " "	" "	3.00 " " "
		Stable, each horse	" "	2.00 " " "
		" " cow	" "	1.00 " " "
		Public Bath Tubs, Water Closets or Urinals, each not less than	" "	5.00 " " "
		Saloons, Bar Faucet—$ 8.00, Beer Pump—$ 5.00	" "	13.00 " " "
		Barber Shop	" "	8.00 " " "
		Stores or Offices	" "	6.00 " " "
		Water Engine for Pipe Organ	" "	10.00 " " "
		Drug Store	" "	8.00 " " "
		Soda Fountain	Summer use	5.00 " " "
		Water Motor for fans	" "	20.00 " " "
		Sill Cock, Yard Hydrant or Hose	" "	3.00 " " "
		" " " " " without other uses	Minimum rate	6.00 " " "
		Other purposes		
			TOTAL $	



Mr F. H. McGregor Main Street

To Southington Water Co., Dr.

FOR WATER RENT FOR SIX MONTHS FROM APRIL 1st, 1910, to OCTOBER 1st, 1910.

Payable May 15, 1910.

House, one family, first faucet	per year	$ 6 00	$ 3.00
House, two families, one faucet each	"	11 00	
Each additional person, over five in family	"	1 00	
Bath Tub, in private dwelling	"	2 00	1.00
Water Closet, in private dwelling	"	3 00	1.50
Stable use, horse $2.00, cow $1 00 Automobile $1.00 Summer Rate	"		
Public Bath Tubs, Water Closets and Urinals, each, not less than	"	5 00	
baboons, Bar Faucet, 8.00; Beer Pump $ 00	"	13 00	
Barber Shop	"	8 00	
Stores or Offices, first faucet	"	6 00	
Drug Store, first faucet	"	8 00	
Water Engine for Pipe Organ	"	10 00	
Soda Fountain, ½ Payable May 15th, balance Nov 15th Summer use		6 00	
Motor for Fans " " " " " "	"	20 00	
Sill Cock Yard Hydrant or Hose, ½ payable May 15th, balance Nov 15th (Hose used as Fountain not included	"	3 00	1.50
Sill Cock or Yard Hydrant without other uses		6 00	
Meter rates from printed schedule			
Washing Machine Motor for private family 2 00 per year			
Other Purposes			
		Total $	7.00
deceived payment 1910			
By			

Office Hours:—From May 1st to . June 1st Southington Office, 46 Center St., 1:30 to 5:30 p.m. and on Monday's and Saturdays, 7 to 8 p.m. Plantsville Store, OFFICE HOURS: Monday's and Saturday's, 2 to 5:30 and 7 to 8 p.m.

Apr. Rent, 1910.

Name F. H. McGregor

Street Main

Paid

$6.00	$ 3.00
11 00	
1 00	
2 00	1.00
3.00	1.50
5 00	
13 00	
8 00	
6 00	
8 00	
10 00	
6 00	
20.00	
3 00	1.50
6 00	
Meter	
	$ 7.00

Comparative Water Rates for Domestic Uses in Connecticut Municipalities.

	Cities	Fam.	Tub.	Set Tub.	Closet.	Hose.	Horse.	Total.
M.	Ansonia	6.00	3.00		3.00	5.00	3.00	20.00
P.	Bridgeport	6.00	5.00		4.00	4.50	6.00	25.50
M.	Danbury	5.00	3.00		3.00	4.00	2.00	17.00
P.	Derby	6.00	3.00		3.00	5.00	2.00	19.00
M.	Meriden	5.00	2.00		3.00	3.00	3.00	16.00
M.	New Britain	5.00	3.50		3.50	3.50	3.00	18.50
P.	New Haven	5.00	3.00		3.00	3.00	3.00	17.00
M.	New London	5.00	2.00		2.00	2.00	5.00	
M.	Norwalk	5.00	3.00		3.00	3.00	2.00	16.00
P.	Putnam	6.00	5.00		5.00	5.00	3.00	24.00
P.	Rockville	5.00	2.00		3.50	3.00	3.00	17.00
M.	So. Norwalk	5.00	3.00		3.00	3 to 5	2.00	17.00
P.	Stamford	6.00	5.00		5.00	5.00	6.00	27.00
M.	Waterbury	5.00	2.00		3.00	3.00	2.00	15.00
M.	Willimantic	6.00	3.00		3.00	3.00	4.00	19.00
	Boroughs.							
M.	Bethel	5.00	5.00		3.00	3.00	2.00	18.00
P.	Branford	10.00	3.00		4.00	6.00	2.00	25.00
P.	Bristol	6.00	3.00		3.00	4.00	3.00	19.00
P.	Danielson	6.00	5.00	3.00	5.00	6.00	3.00	28.00
	Fenwick	8.00	5.00	2.00	5.00	2.00	5.00	27.00
P.	Groton	6.00	5.00	3.00	5.00	6.00	3.00	28.00
P.	Guilford	8.00	5.00	2.00	5.00	5.00		25.00
P.	Jewett City	6.00	4.00		4.00	5.00	4.00	23.00
P.	Litchfield	12.00	5.00		6.00	5.00	2.00	30.00
P.	Naugatuck	6.00	3.00		3.00	4.00	3.00	19.00
P.	Ridgefield	10.00	6.00	5.00	6.00	8.00	8.00	43.00
P.	Shelton	6.00	3.00		3.00	5.00	2.00	19.00
P.	Stafford Spr	6.00	3.00	2.00	3.00	5.00	4.00	23.00
P.	Stonington	6.00	5.00		5.00	6.00	3.00	25.00
P.	Southington	6.00	2.00		3.00	3.00	2.00	16.00
P.	Torrington	6.00	3.00		3.00	4.00	2.00	18.00
M.	Wallingford	5.00	3.00		3.00	3.00	3.00	17.00
M.	Winsted	5.00	1.00		2.00	5.00	2.00	15.00

Compiled by Southington Water Co. Southington Meter Rates. Large Quantities 8 cts. per 1,000 gals., less 10 per cent. for over $500. per year.
M. Municipal., P. Private.

Points of Value in Catchbasin Construction.

Mr. John W. Stipes of Champaign, Ill., has two devices which enable him to build two 6½-foot catch basins per day. These catch basins are of standard diameter common on street drainage work, with 8-inch walls of brick and cast iron tops, and Mr. Stipes's working force consists of one mason and a helper.

The first of these devices is a mortar board, semi-circular in shape, with the curved side of the radius of the catch basin. To this curved, or back side, is nailed a strip extending up above the surface of the board, so as to prevent any material from being pushed off by the mason's trowel. To this strip are attached four ropes at the quarter points of the semi-circumference, and these ropes are attached to a single rope, which passes over a board thrown across the top of the pit. The whole contrivance may me raised or lowered at will so as to be always in the most convenient position for the mason.

The second device, though very simple in itself, is most valuable as a time-saver. It consists of an arrangement for

lowering bricks into the pit. Six or eight bricks are placed upon two boards, placed far enough apart so that a rope may be placed between them. The rope is then drawn up around the brick and is held tightly in place by an iron hook bent at an angle of about 90 degrees. The bricks are then lowered into the pit and a slight twist of the rope unfastens the hook, allowing the rope to be withdrawn from around the bricks. The value of the latter factor lies in the fact that one helper can keep the mason supplied with both bricks and mortar and entirely without the aid of the mason, who can give his undivided attention to bricklaying.

Cost of Brick Paving in Florida.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Referring to the cost of vitrified brick paving in Florida, I would say that vitrified brick paving recently done here on Central avenue, 60 feet wide, with granite curbing, laid with no foundation other than sand, cost the city $1.54, and was done by contract.

W. T. T., St. Petersburg, Fla.

A Convenient Paving Brick Carrier.

Mr. John W. Stipes, a contractor of Champaign, Ill., has been using a very convenient "home-made" device for handling his brick upon pavement work. The brick, as is usual in most paving work, where such is possible, are delivered upon the site of the work and piled along either side of the street. The usual method of delivering the brick to the layer is to either carry them with hand carriers or to wheel them in wheel-barrows and dump them.

Mr. Stipes's carrier is as follows: He has a continuous series of rollers fastened between two rigid guide braces. These rollers are three inches in diameter, and are held in place by spikes driven through the guide strips and into the ends of the roller. The guide strips or braces are five inches in width, so as to extend on either side of the rollers. The rollers are made to revolve easily and with as little friction as possible.

The method of operation is as follows: One end of the carrier is placed upon a horse at the side of the street and the other rests upon the pavement just laid. One man places the brick upon this carrier allowing them to slide down to the layers. The carriers are usually operated in pairs necessitating four men to handle the brick.

The advantages of the carrier lie in the fact that the brick are delivered just as needed; they are not chipped and broken by being dumped from a wheel-barrow; the dirt incident to running a wheel-barrow on and off the pavement is obviated (a big factor where the pavement is to be grout or asphalt filled); and only four men are needed to handle the brick, where five or six are needed in the wheel-barrow or hand methods.

Mr. Stipes also employes the carriers in unloading brick from cars and in delivering brick and fireproofing into buildings.

Calcium Chloride and Its Action on Road Surfaces.

From a report of a successful test of calcium chloride as a preventer of dust on country roads, made in England, a description of the chemical and of the nature of its action on the dust in a road is abstracted below. It will be noted that a rather humid atmosphere is necessary for complete success in the operation and therefore it may be expected that in many parts of this country and for periods of each year, which may sometimes be quite prolonged, the humidity will be so low that the virtue of the calcium chloride will be temporarily lost by the lack of moisture to absorb from the air. This may be overcome to some extent by occasional sprinklings. It may also be remarked that heavy rains are more frequent in this country than in England and that on this account the calcium chloride will be more completely and more frequently washed out of the surface, so that renewals will be necessary at more frequent intervals. It is very probable, therefore, that there are but few localities in this country in which this chemical will prove as satisfactory as it has in England. Following is the extract from the report of the test:

Calcium chloride is produced in large quantities as a by-product in the ammonia-soda process of manufacturing common washing soda and in certain other chemical processes. It may be obtained in a number of forms varying in composition only according to the amount of water contained therein. For instance, the common crystals of calcium chloride contain about 50 per cent. of water and 50 per cent. of true calcium chloride. Another fairly defined modification contains about 76 per cent. of calcium chloride and 24 per cent. of water. By strong heating it may be obtained free from water. In all these, and in intermediate states, it has the property in a marked degree of absorbing moisture from the surrounding atmosphere, and if left exposed to damp air it eventually becomes a thick, syrupy liquid through the absorption of moisture. If it is then exposed to a dry atmosphere it will gradually part with some of this moisture and reabsorb moisture when again exposed to a moist atmosphere. It is on this property of absorbing large quantities of moisture that the utility of calcium chloride for laying dust on roads depends. The salt for the "dry" method of treatment was in a granulated form and contained about 70 per cent. of true calcium chloride and 30 per cent. of water. The effect of spreading this salt on the road is that it rapidly absorbs moisture from the atmosphere, the granules thus soon becoming soft, moist globules, which ultimately liquefy by further absorption of moisture and are then absorbed in the pores or interstices of the road surfacing material. The syrupy nature of the liquid which

results from calcium chloride by the absorption of water hinders its removal from the road material by washing due to rainfall, though ultimately prolonged wet weather must result in the extraction of nearly the whole of the salt from the material. The trials demonstrated, however, that even in very favorable conditions for the removal of the salt from the road material by rain an appreciable amount was retained for several weeks.

When absorbed in the pores and interstices of the road the calcium chloride takes up or gives off moisture according to the degree of humidity of the atmosphere at the time. Thus on a dry, hot day it will tend to become dryer, but will never in the conditions in this country pass beyond a certain stage in which it is still a syrupy substance, having more or less binding action due to its viscosity on the road material in which it has been absorbed. On the other hand, when the humidity of the atmosphere is increased, as is commonly the case at nightfall in this country, even on dry days, the calcium chloride absorbed in the road will take up moisture from the atmosphere and thereby render the road material moister than before. Thus in summer weather the effect of the treatment of a road surface with calcium chloride is to provide the material of the road with an ingredient which keeps it in a slightly damp conditon by absorption of moisture from the atmosphere. Even in the dryest and hottest weather the road cannot become absolutely dry, and any dust or small particles which are picked up from it must, owing to the heavy syrupy solution of calcium chloride incorporated with them, be disinclined to break up into small, fine particles which would be carried or held in suspension for any appreciable time in the atmosphere. Consequently any dust which may be raised from a road treated with calcium chloride is of a denser and less finely divided description and so falls to the ground more rapidly. Calcium chloride is a body without any pronounced toxic or corrosive properties. By its solution in water the temperature of the water is considerably reduced for the time being, and a solution of calcium chloride in water freezes at a considerably lower temperature, depending on the amount of salt in the solution, than pure water.

MUNICIPAL MATTERS IN COURT

Higher Courts—Pennsylvania Courts—Michigan City Paving—Tennessee Front Foot Law—Denver Civic Center—Sewer Contractor vs. Water Pipes—Plymouth's New Bridge—Nebraska Paving Law—North Platte Water Works

Decisions of the Higher Courts of Interest to Municipalities.

City Engineer—Streets—Boundaries.—Where, in mandamus by a property owner to compel a city engineer to ascertain and disclose the location of the street line in front of her property, the city engineer on the trial admitted that he had refused to disclose the true line based on data, which he deemed controlling, or any other line than that claimed by the city authorities, admittedly contrary to his own conclusions on the subject, the court was authorized to terminate the hearing at that point and award a peremptory writ requiring the ascertainment and disclosure of the true line as required by the ordinance. A city was not a necessary party to mandamus against a city engineer to compel him to ascertain and disclose to relator the true line of a street under an ordinance declaring that every person contemplating the building of houses, walls, or fences, before doing so, shall have the line or lines of the lots running on the street established by the city surveyor, and for violation thereof shall be subject to a fine.—Giraud, City Engineer, v. Winslow (Tex.) 127 S. W. 1180.

Municipal Indebtedness.—An agreement by a village to pay a specified sum annually for arc lights during a specified period constitutes an indebtedness for the whole amount, and is illegal if exceeding the constitutional limit.—Evans et al. v. Holman et al. (Ill.) 91 N. E. 723.

Public Works—Contracts—Authority of Officers — Fixing of Salary — Greater New York Charter (Laws 1897, c. 378), sec. 455, authorizing the commissioner of bridges, when thereto authorized by the board of estimate and apportionment and board of aldermen, to employ a consulting engineer skilled in bridge construction, and Laws 1897, c. 665, providing for the establishment of a public drive and parkway as an extension of Riverside Drive, did not authorize the commissioner of highways to contract with an engineer to furnish plans and specifications for the drive and superintend a part of the work for compensation based upon a percentage of the cost, until such plans and specifications were approved by the board of esti-

mate and apportionment, and such contract was not the fixing of the salary of a consulting engineer.—Hildreth v. City of New York (N. Y.) 122 N. Y. S. 1054.

Specific Performance — Conveyance of Waterworks System—Alternative Relief. —In an action to specifically enforce a contract for the construction of a waterworks system and compel a conveyance to the city of the system and determine what amount the city should pay therefor, a decree determining that there should be deducted from the price agreed on the cost of establishing sewage disposal works, so as to prevent contamination of a river, which contamination had been contracted against, and then modifying such provision by giving the waterworks company leave to present a plan for preventing the pollution of the river which would be less expensive, and if found good the cost of that plan to be deducted from the contract price, is fair and just, and affords no ground for criticism.—Mayor, etc., of Jersey City v. Jersey City Water Supply Co. (N. J.), 76 A. 3.

Defective Streets—Liability.—Where an excavation in a street for sewer and water connections was made by a plumber employed by the abutting owner in pursuance of permission granted by the city department of public works, and under the control of the city engineer, and subject to a penalty for failure to restore the street to its former condition, the city was a joint actor with the owner in making the excavation, and was liable for failure to restore the street to its former condition.—Tabor v. City of Buffalo (N. Y.) 120 N. Y. 1089.

Paving Contracts—Extras.—Within a contract for paving a street with asphalt, exacting the laying of concrete on the old foundation of a wooden block pavement to bring the surface to subgrade before the laying of the asphalt, and providing that there should be no compensation for "extras," the laying of the concrete, an essential portion of the work, for which separate bids had been taken, is not an extra.—Fullerton et al. v. City of Des Moines et al. (Ia.) 126 N. W. 159.

Street Improvements — Advertisements for Proposals.—The advertisement for proposals, where a wooden block pavement laid on a concrete foundation was to be succeeded by an asphalt pavement on the same foundation, stating that the asphalt was to be laid "on the present cement concrete foundation," that the improvements were to be "as per the plans and specifications," which required the old foundation to be brought to subgrade, that the new concrete necessary for resurfacing said foundation "be measured in boxes * * * satisfactory to the city engineer or in any manner he may direct," and that separate bids be made for "asphalt paving on old concrete foundation," and "for extra concrete per cubic yard," sufficiently shows that the "extra concrete" is to be placed on the old foundation in bringing it to subgrade.—Fullerton et al. v. City of Des Moines (Ia.) 126 N. W. 159.

Indebtedness—Issuance of Bond—Necessary Expense.—The protection of a town from fire and disease by providing water and sewerage is a "necessary expense," within the meaning of Const. art. 7, sec. 7, and Revisal 1905, sec. 2974, providing that no muncipal corporation shall contract any debt, pledge its faith, or loan its credit, nor shall any tax be levied or collected by any officers of the same except for the necessary expenses thereof, unless by a vote of the majority of the qualified voters, therein, and, therefore, a vote of the people is not required to render bonds issued to provide waterworks and a sewerage system valid, in the absence of statutory restriction enacted under Const. art. 8, sec. 4, making it the duty of the Legislature to restrict the power of cities to tax, borrow money, contract debts, or loan their credit.—Underwood v. Town of Asheboro (N. C.) 68 S. E. 147.

Street Improvements—Action for Cost—Limitations.—Act April 19, 1890 (Acts 1889-90, c. 902), amending Lexington city charter, provides that the cost of a street improvement shall be borne two-thirds by the owner of abutting property, and one-third by the city, unless he requests the adoption of the "ten-year plan," in which event he pays the whole cost in installments, for which the city issues bonds and pays interest thereon. *Held,* That in absence of request therefor, the adoption of such ten-year plan did not extend the limitation period beyond five years from completion and acceptance of the work, and the city's cause of action under such act was barred in five years from its accrual, pursuant to Ky. St. 1903, sec. 2515, barring in that time liability to pay for street improvements.—City of Lexington v. Woolfolk (Ky.) 128 S. W. 104.

Duty of City to Prevent Obstruction.—It is the duty of a city to so construct and maintain its sewer drains as to prevent clogging with sewage to the annoyance and damage of property owners. Where the complaint, in an action against a city for a nuisance from allowing the outlet of a sewer to become clogged, alleges that the sewage empties into an open ditch, rendering plaintiff's lots less desirable for building purposes, and that the overflow from the ditch carries offensive matter on the lots, and renders them worthless for garden purposes, to plaintiff's damage in a specified amount, it sufficiently shows injury to plaintiff.—Cannelton v. Bush (Ind.) 91 N. E. 359.

Compelling Performance of Official Duty.—The charter of a municipality conferred upon it the power "to own, use, and operate, for municipal purposes and for profit, a system of waterworks and electric lights, to make rules and regulations regarding the use of the same by the pub-

lic, and to provide by ordinance for the punishment of those who illegally use said water or light. A resident filed a petition for mandamus to compel the municipal authorities to supply water at her residence. It was alleged that the municipality had established a water system, with which the applicant's residence was connected, and was serving the public generally, but without cause had stopped applicant's supply of water and refused to serve her, although she was due nothing for water rent, and tender of payment in advance was made for the service desired. *Held,* That the petition was not subject to dismissal on the ground that the plaintiff had a specific legal remedy. Camilla v. Norris (Ga.) 67 S. W. 940.

Three Mile Law Constitutional.—Burns' Ann. St. 1908, sec. 7712, authorizing a petition by freeholders of any township including any incorporated city or town having a population less than 30,000, for the improvement of highways therein, is not unconstitutional as class legislation because it only applies to townships in which are cities or incorporated towns having 30,000, or less, population. All public highways are "state highways," and the state is the sole arbiter of the manner and conditions of their improvement, except as limited by the Constitution. Burns' Ann. St. 1908, sec. 7719, providing that, where the road proposed to be improved is less than three miles in length, connected at each end with an improved road, or connecting an improved road with a boundary of the township, etc., the commissioners may authorize the improvement without submitting the question to an election of the voters, and providing generally for elections, is not unconstitutional as discriminative in favor of roads less than three miles long, and in favor of roads having certain termini, etc.—Cummins v. Perce et al. (Ind.) 91 N. W. 529.

Contracts—Notice for Bids—Validity. —Seattle City Charter, art. 6, sec. 14, provides that, before letting a city contract, the board of public works shall cause a notice to be published, inviting sealed proposals, "the plans and specifications whereof must, at the time, be on file in the office of the secretary of the board, subject to public inspection." *Held,* That where the equipment of an automatic fire alarm central office for a city, as designed by the city electrician, was authorized by ordinance, a subsequent notice to bidders, after a call for bids had been published, which abrogates the specifications, and establishes in lieu thereof an equipment which the board and city electrician may deem adequate, renders the bids for the contract and all subsequent proceedings void. Resident taxpayers may maintain a suit to restrain a city and its board of public works from the execution of an illegal city contract, though an unsuccessful bidder for the contract caused the suit to be commenced, and will defray the expenses thereof.—Goshert et al. v. Seattle et al. (Wash.) 107 Pac. 860.

Public Water Supply—Rights—Discrimination.—An incorporated water works company, being a quasi public corporation, cannot make a discriminatory rate for or against its customers. In a suit to enjoin a water works company from shutting off the water supply from a state institution located within the village unless it paid a 20-cent rate claimed to be discriminatory, an allegation of the answer that the 12-cent rate to which the state institution claimed to be entitled was made for the inhabitants of the village for the reason that defendant's contract to furnish water to the village for fire protection for a certain sum annually required that the water be furnished to the inhabitants of the village at that rate did not allege that the sum named, plus the 12-cent rate, aproximately equaled the rate demanded of the state institution so as to constitute a defense to the suit. —People v. Albion Water Works Co. (N. Y.) 121 N. Y. 660.

Construction of Sidewalk—Exercise of Police Power.—A city can construct a sidewalk and charge the expense against the adjacent lot under the exercise of the police power and regardless of benefits. Acceptance of a walk by a city is not binding on a lot owner where it would operate as a fraud on him. A complaint to set aside a sidewalk assessment alleging that as constructed it was practically worthless set forth a fact which showed a legal fraud perpetrated on plaintiff, and stated a cause of action. In a suit to set aside a sidewalk assessment because the walk was practically worthless, the contractor who was paid for the work was a proper, but not a necessary, party; defendant city being the owner of the improvement certificate.—Eiermann v. City of Milwaukee et al. (Wis.) 126 N. W. 53.

Reconstruction of Sidewalks — Rights of Abutting Owners.—The Milwaukee city charter (Comp. 1905, c. 7, sec. 17) provides that the board of public works may by resolution declare any sidewalk to be dangerous, when in its judgment it is so, and may order it repaired or relaid, and employ any person to do so at a fair price, and by special assessment charge the expense of the abutting land, and such an assessment is made a lien against such adjacent property without any estimate, notice, letting, or other preliminary proceeding except the resolution. *Held,* That the sole protection given the landowner thereby was that the walk must be repaired or relaid "at a fair price."—Eiermann v. City of Milwaukee et al. (Wis.) 126 N. W. 53.

City Water Works—Negligence—Liability—Where a city, operating a system of water works furnishing water to its citi-

zens, controlled the cock at the junction of service pipes and the main pipe, by which water was let on and off, it must remove an obstruction therein within a reasonable time, and where it failed to do so it was liable for injuries sustained by one by reason of an nsufficient water supply. Where a city failed to remove an obstruction in its system of water works, whereby a citizen was deprived of water for domestic purposes, the damages sustained were not limited to actual money losses; but he was entitled in addition thereto to compensation for the trouble and inconvenience suffered by being deprived of water.—City of Jackson v. Anderson (Miss.) 51 S. 896.

Water Supply — Contracts—Acceptance of Offer.—Five days before the expiration of a five-year contract between a railroad company and a public water company, the manager of the water company wrote the railroad superintendent that he could no longer furnish water at the former rate. The superintendent did not reply, and in two days after the expiration of the contract the manager wrote again, stating that at the expiration of the contract he had comenced to charge the railroad at the advanced rate. Eight days after receipt of the second letter, another official of the railroad replied, refusing to make a contract. *Held,* That the railroad company's silence for eight days after receiving the water company's proposition, and the acceptance of water after the expiration of the first contract and whle the water company's proposition was pending, and payment made for the water at the higher price, was not an acceptance of the offer, so as to form a contract for another five years at the advanced price, especially as the water company was a public service company, and under its charter bound to furnish water to the railroad company when properly compensated therefor.—Vicksburg Water Works Co. v. Yazoo & M. V. R. Co. (Miss.) 51 S. 915.

Water Works—What Constitutes.—One who obtained from a city a franchise authorizing him to sink an artesian well to supply water to the public therefrom for pay, through mains and pipes which he was authorized to lay over certain streets in a particular part of the city, was conducting a system of "water works," within Code 1906, sec. 3886, imposing an annual privilege tax on water works in cities; the fact that the water supply is an artesian well not making the business taxable as an artesian well, instead of a water works, where the main purpose of the well is to conduct a water works business, and is not merely incidental to its use by the owner.—Randall v. Smith, Tax Collector (Miss.) 51 S. 917.

Extent of Municipal Ownership—Public Use.—A city, taking land for widening a highway, may not, in connection therewith, take additional land, with a view to a subsequent sale thereof at full value, though the taking of the additional land is necessary to promote adequately the commercial and industrial welfare of the city, such an enterprise not being a public use, within the Constitution, and it is immaterial that public funds are not to be used for the construction of buildings on the additional land. A city may not take land outside a public work for speculative purposes, but there may be such a remnant of an estate, a part of which is necessarily taken, so small, or of such a shape, and of so little value, that the taking of it in the interest of economy or utility may be fairly incidental and reasonably necessary in connection with the taking of land for the public work.—In re Opinion of the Justices (Mass.) 91 N. W. 578.

Public Improvements—Lien for Materials.—One furnishing materials to a subcontractor of a city contractor, who has sublet part of the work by a contract giving the subcontractor no right to look to the city for pay, is not within Laws 1882, p. 866, c. 261, giving materialmen a lien on money due from the city to the contractor or his assigns.—Milwaukee Lumber Co. v. City of Milwaukee (Wis.) 123 N. W. 653.

Measurement of Sewer.—A contractor for city sewers, who was paid for constructing manholes, could not in measuring the length of the foundation under the sewer measure from center of manhole to center of manhole, for to do so he would be paid twice for the same work.—Shea v. Sewerage & Water Board of New Orleans (La.) 50 S. 166.

Municipal Indebtedness—Constitutional Limitations—Right of Taxpayers.—Where a village acquired an electric light plant for $11,496, by issuing $4,200 of bonds, which was the constitutional limit of indebtedness, subject to the payment of a mortgage indebtedness on the plant of $7,296, as it matured, and taxpayers made no objection to the purchase of the plant nor to the insuance of the bonds by the vendor, but merely sought to prevent the payment of any price above $4,200, and the officers of the village insisted that the transaction was legal and that the income of the plant would pay for itself, the court could only enjoin the payment of the mortgage indebtedness except out of the net income of the plant after paying operating expenses and necessary repairs. A municipality does not create an indebtedness by obtaining property to be paid for wholly out of the income thereof.—Evans et al. v. Holman et al. (Ill.) 31 N. E. 723.

Damages or Penalty.—The holders of a city gas franchise, in consideration of an extension of time within which they were required to equip their plant and place themselves in readiness to furnish gas, executed a bond by which they agreed to pay the city $1.000, on condi-

tion of their failure, within the time as extended, to have gas piped to the city and be in a position to supply gas, such amount to be payable to the city on April 26, 1909, unless gas should be supplied as provided. The ordinance extending the time required that the bond should be executed, and that the penalty thereof should be considered as liquidated damages. Held, that the amount so provided for should be regarded as liquidated damages, and not a penalty, and that on failure of the franchiseholders to perform they and their surety were liable to the city on the bond without proof of actual damages.—City of Marshal v. J. W. W. S. Atkins et al., (Tex.) 127 S. W. 1148.

Paving.—Municipal Contract.—A taxpayer has the right to come into court to enjoin the execution of a paving contract, which has been adjudicated without affording opportunity for competition, unless the property holders, by their petition, fix the price for a patented pavement, or a pavement containing a proprietary ingredient.—Saxon v. City of New Orleans, (La.) 50 S. 663.

Municipal Water Company—Insufficient Fire Protection—Suit for Loss—Liability.—A city in contracting with a water company for fire protection represents its inhabitants, and contracts for their benefit, and one who suffered a loss by the company's default was the real party in interest in a suit by him therefor, and was not bound by the testimony of the fire department that the water pressure was all right; and hence a motion for a peremptory instruction for defendant, based on such testimony, was properly overruled. A water company, under contract to maintain a certain pressure in its mains for fire protection, need not do so till it has notice of a fire, but is then bound to put it on, and it is not liable unless it fails to comply with its contract, and its failure is the proximate cause of loss.—Georgetown Water, Gas, Electric and Power Co. v. Neale, (Ky.) 125 S. W. 293.

Municipal Matters in Pennsylvania Courts—Cases of Interest from the "Municipal Law Reporter."

Damages for Defects in Sidewalk—Contributory Negligence.—The plaintiff was injured by stepping on a loose gutter grate in the city of Lancaster. It was shown that the plate was not so fastened as to be kept in place; that for a long enough time to show constructive notice to the city it was frequently loose. *Held,* that the plaintiff was guilty of contributory negligence and that the city of Lancaster was not liable for damages.—Clark v. City of Lancaster (Pa.), vol. 1, 229.

Damages for Excessive Slope of Sidewalk—Contributory Negligence.—Plaintiff in seeking to pass two ladies on the sidewalk, slipped and fell, sustaining injuries for which he asked damages. The sidewalk was 10 feet 6 inches wide. From the house line to the center it sloped 1 inch toward the gutter. In the next 2 feet 8 inches the slope was 4 inches, and in the next 2 feet 8 inches the slope was 8 inches. *Held,* that his injury was due to contributory negligence and not to the excessive slope of the walk, as the plaintiff testified that he had seen that there was a heavy grade.—Stitzel v. Marietta Borough (Pa.), vol. 1, 239.

Sewer Drops and Sub-Drain as Part of Cost of Grading, Paving and Curbing.—It was held that the changing of sewer drops and sub-drains incident to the construction of grading, curbing and paving was essentially a part of the cost of the grading of the street and was made for the benefit of the street entirely.—In re Improvement of Jackson Street (Pa.), vol. 1, 244.

What Constitutes Dedication.—The mere dedication on the part of owners does not of itself make the streets and alleys of a plan public highways. The additional requirements that the plans must be approved by the council and recorded must be fulfilled before the streets and alleys may become public highways. The approval of the council is to a certain extent obligatory upon the council unless there is good reason why a plan should not be approved. In re Improvement of Jackson Street (Pa.), vol. 1, 245.

Roadbed of Railroad Not Liable to Assessment for Local Assessment on Municipal Claims.—The roadbed of a public railroad is not "real estate" within the meaning of the act of June 4, 1901, P. L. 364, and is not subject to assessment for local taxation nor municipal claims.—Philadelphia to Use, Appellant, v. Fairhill Railroad Co. (Pa.), vol. 1, 148.

Act of May 6, 1909, P. L. 441. Providing for Recovery of Moneys, Labor and Materials Furnished by Sub-Contractors for Municipal Improvements Is Unconstitutional.—The act in question provides that a sub-contractor may file a lien at any time before an improvement or work is completed. Such a claim shall be a lien for the principal and interest of the value or agreed price of such labor or materials applicable to the construction of such improvement. The act was held unconstitutional in that it provided for a limited class of persons a special remedy for the securing and recovering of a particular kind of debt due this limited class of creditors.—Ley Construction Co. vs. County of Allegheny (Pa.), vol. 1, 276.

A Street Railway Company Must Keep a Street in Good Repair.—Opinion by Holt, P. J., holds that a street railway company, under its franchise, may be compelled to keep a street in good repair.

The bill requires specific performance.—Rochester v. Street Railway Company (Pa.), vol. 1, 281.

Paving and Grading—Assessment, Manner of Levying by Viewers.—The courts may pass upon the legality of an assessment, which is a form of taxation; but they have no authority to levy such an assessment nor to pass upon the values of property nor the extent to which such property is benefited. Where viewers make a report and it appears from the report that the special benefits are in exact proportion to the extent of the frontage of the property, such a result is not illegal simply because it might have resulted from the use of the front foot rule.—Walnut Avenue Improvement (Pa.), vol. 2, 32.

Street Improvement Under Tennessee Front Foot Assessment Law.

A decision by Chancellor Minor of Tennessee approves the amendment to the front foot assessment law, which has been under doubt. This amendment gives the city the initiative in ordering street improvements, two-thirds of the cost of which is paid by the abutting property owners. The amendment further dispenses with the necessity of a petition from 60 per cent. of the owners of abutting property. This decision gives the city the power to order improvements up to the limit of its proportionate bond issue.

Litigation Arising from Michigan City Pavement Contract.

In a complaint filed in the Federal court at Indianapolis by the Warren-Scharf Asphalt Paving Company, a corporation of New York, against the city of Michigan City, Ind., a story is told of a tangle that resulted from an effort to straighten out a contract between the city and the paving company. The case grows out of the paving company having improved three streets in Michigan City, and the complaint is divided into three paragraphs, in each of which judgment is asked on the ground that certain money is still due the paving company for the improvements. The judgments asked aggregate $12,000. It is alleged that there is due, as unpaid assessments for the improvements, more than $6,000 for the three streets.

The complaint grew out of the city having originally accepted the bid of another contractor and then having awarded it to the plaintiff as the next lowest bidder. Some of the property owners contested the payment of assessments to pay for the improvement, and the matter was carried to the appellate court of Indiana, where it was decided that the contracts between the city and the plaintiff were invalid, as the city should have readvertised for new bids.

In an effort to remedy this the board of works then advertised for bids for the improvement of the three streets, and, after accepting the bids of the plaintiff, adopted a resolution declaring that the performance under the old contracts by the plaintiff be accepted as a performance under the new contracts. It is alleged, however, that the board refuses to make a final assessment against those property owners who have failed to pay their assessments.

Sewer Contractor Restrained from Interfering with Water Pipes.

Taking the stand that the defendant's interference was both unnecessary and arbitrary, Judge Fuller in an opinion handed down in the case of the People's Water Company of Pittston against Edward Healy, a sewer contractor, continues the injunction restraining the defendant from laying pipes which injure the plaintiff's mains.

The action was brought some weeks ago and was to restrain the defendant from laying sewer pipes over the pipes of the plaintiff. The defendant had a contract with the city of Pittston to construct a sewer upon Tompkins street, the specifications providing that the sewer was to be laid in the center of the street.

It was alleged on the part of the company that the defendant constructed the sewer in the center of the street for a certain distance and that work on one end of the sewer was begun on the westerly side of the street so as to interfere with the company's pipes. The weight broke the water mains and cut off the supply to the hospital and other patrons.

Nebraska Paving Law Constitutional.

The decision given by Judge Troup in the Florence paving case will affect similar cases which have been pending in Nebraska villages for several months.

In the Florence case Judge Troup held that the contract awarded by the village board a year ago to M. Ford was valid. The decision upheld the constitutionality of the law, upon which the attack was made. The village board of Dundee has been holding back in its paving vote until the decision should be made.

Denver Wins Civic Center Suit.

A decision by Judge Riner of the U. S. Circuit Court dismissed the case of Wm. J. Pochin, who sought to block the Denver Civic Center improvement. It was proven that in order to bring the case under the jurisdiction of the Federal court a transfer of property valued at $12,000 had been made for the consideration of $1. This evident collusion of the parties back of the suit was responsible for its dismissal from court. The next step on the part of the city will be

the appointment of a condemnation commission and the introduction of the assessing ordinance in the city council.

The improvement in question contemplates the acquisition of a tract of land for the purpose of a plaza. This plaza is to contain the library, the Pioneer monument, ornamental fountains and a stadium for out-of-door meetings.

Plymouth Wins Suit for New Bridge.

About two years ago Plymouth, Pa., started a movement to build a highway bridge across the Susquehanna river. Authority was given to the commissioners to build a structure to cost $175,000. Viewers were appointed and they returned a report fixing the cost at about $50,000 in excess of the above amount. The commissioners, believing they had no authority to make such expenditure, refused to go ahead with the work. A suit was then brought to compel the erection of the bridge, with the result that a mandamus was granted by Judge Ferris compelling the construction to be carried out.

North Platte, Nebraska, Released from Water Works Contract.

In the case involving the ownership of the North Platte water works, valued at $85,000, Judge Munger has decided that the city cannot be compelled to take over the water works against its will. The point at issue was whether the city council had made a valid agreement and contract with the company to take over the plant on the terms offered by the company.

Judge Munger holds that it was necessary for the council to pass an ordinance in the matter, specifically agreeing to take the plant. Instead of this procedure council passed a simple motion. This the court holds was not sufficient.

WATER AND LIGHT

Urbana Water Works—Brooklyn Water Supply—Saginaw Fire Pressure—Illinois Surface Waters—Mississippi Basin Waters—Johnson City Water Works—Card Index for Fire Fighting—Telephone Fire Alarm—Crawfordsville Gas—Birmingham Gas Profits—Tarsus Has Electric Light—Pasadena Light—Westfield Municipal Gas Plant—Ornamental Street Lighting

Increased Water Supply for Brooklyn.

The sources of water supply in Brooklyn and Queens will be greatly increased by the appropriations which have been made for that purpose by the board of estimate. The water supply in Long Island City is to be connected with the Croton supply in Manhattan, and the outlying sections of Brooklyn, such as Borough Park, New Utrecht and Coney Island, will receive new distributing mains.

For Queens the board has authorized an appropriation of $450,000. The plan is to lay a 48-inch pipe line through Eighty-second street, Manhattan, from the Central Park reservoir to the East river. The pipe line under the East river will be 38 inches in diameter, and the distributing mains in Long Island City will be reduced to 30 inches.

This additional source, it is expected, will increase the water supply in Long Island City sufficiently to obviate the necessity of purchasing some of the private water companies which are now operating in Queens Borough.

The following appropriations, which were authorized some time ago by the board, have been rescinded: $435,000 for a new pumping station at Massapequa and $350,000 for new distributing mains in the Seventh, Twenty-third, Twenty-fifth and Twenty-sixth wards.

Saginaw Needs Higher Fire Pressure.

Fire Chief George W. Walles, of Saginaw, Mich., has requested through the local papers that when a fire alarm is sounded all lawn hose and house connections will be promptly turned off. This is necessary in order to obtain the required fire pressure where needed.

Urbana, O., to Purchase Water Works Plant.

After years of litigation the city of Urbana, O., has decided to own and control its own water works plant. Some months ago Robert W. Kirby, receiver of the Urbana Water Works Company, sued the city to recover money claimed to be due him as a result of the raising of the rates for furnishing water to the city. He was awarded a very large sum as back pay, and thereupon the city authorities appealed the case to the Federal Court of Appeals.

Receiver Kirby reports that on June 24 last the city council of Urbana passed a resolution, approved by the mayor, providing for the purchase of the plant for $150,000 and to withdraw its appeal from the decree made last December in favor of the receiver. Judge Hollister at once made an order giving the receiver authority to accept the proposition, subject to the approval of the court.

Surface Water Supplies of Illinois Impure.

A report issued by the United States Geological Survey sounds a warning to the cities of Illinois, outside of Chicago, regarding the purity of the sources of water supply. Chicago's Lake Michigan water is pronounced the best in the state, but most of the rivers and other streams examined show so much impurity that their waters constitute a menace to health. The report asserts that almost any surface water in Illinois is sure to be polluted and dangerous to use for drinking. By far the greater number of Illinois cities of large size obtain their water supplies from surface waters which are badly polluted.

The investigation was made by W. D. Collum, assisted by Edward Barton, director of the Illinois River Survey; L. P. Breckenridge, Arthur N. Talbot and Samuel W. Parr, of the engineering experiment station at the University of Illinois, and H. Foster Baird, of the Illinois Geological Survey.

Samples of the findings in the cases of the rivers and the cities at which waters were examined are as follows:

Sangamon river, Decatur, Springfield, Chandlerville—At Decatur the water is treated and furnishes a satisfactory supply; at Springfield it is neither inviting to drink nor cleansing.

Illinois river, La Salle, Peoria, Kampsville—Illinois water is not used for municipal supply; it is doubtful if the time will ever come when it will be looked upon with favor as a source of municipal supply. The large amount of sewage in the Chicago drainage canal would make people hesitate to undertake the purification of the water.

Mississippi river, Moline, Quincy, Chester—Where the river furnishes the supply of water for domestic uses some method of purification is used.

An explanation is offered in the report for the variations in the quality of water at different times and places.

Surface Water Supply of the Upper Mississippi River and Hudson Bay Basins.

In United States Geological Survey Water Supply Paper 245 is given a complete record and description of the surface drainage of the upper Mississippi river and Hudson Bay basins. The paper was prepared, under direction of Mr. M. O. Leighton, by A. H. Horton, E. F. Chandler and R. H. Bolster.

Municipal Water Works for Johnson City.

Johnson City, Tenn., has purchased the entire pipe line distributing system of the Watauga Water Company. The purchase price named was $140,000.

The Card Index Applied to Fire Fighting.

The *Montreal Daily Witness*, in connection with comment on the $500,000 *Montreal Herald* fire, proposes a system to aid in the intelligent handling of large fires. The plan is as follows:

That there be created a card index, which, with simple and conventional diagram and signs, would indicate at a glance the nature of a building and its contents, and particularly the location of dangerous features, such as excessive weights on upper floors, explosives, or basements from which there are no exits, and so forth, and that would indicate the position of stairs, elevators, fire escapes and other exits, that would show the precise position of the main gas cock and electric light switch, so that these might be immediately shut off on the arrival of the firemen, thus preventing adding fuel to the fire or endangering those in the building by asphyxiation through the escape of gas, and preventing electrical short circuits and the danger to those in the building of electrocution through damaged wires. The diagram or chart would also show in simple way the position of machinery or valuable stock, in the first instance, for the guidance of the salvage department, and also that the chief may know in what part of the building there is most treasure. The diagram might also show in conventional fashion the kind of roof, the nature of the walls, showing also any internal unprotected connection with adjoining buildings. Figures at the upper right-hand corner of each flat would indicate the number of employes belonging to such flat, and immediately under them other figures would indicate the value and approximate weight of the contents of that flat. Light machinery might be indicated by a series of light crosses, heavy machinery by heavy crosses, and the underscoring of anything emphasizing that it was, comparatively speaking, of special value. The letters "VS" might show the location of particularly valuable stock, and a circle with a heavy "T" in it the position of treasure, not only such as specie and jewelry, but such, for instance, as special dies and tools, which are sometimes as valuable, if not more so than jewelry itself. Any explosive material might be indicated by a sun with an "X" in the center, while a dangerous weight on an upper floor would be indicated by a black block.

It is suggested that there be four copies made of the card for each building, one to be placed conspicuously near the main entrance, one to be sent to the fire department, one to the building inspector

and one to the factory inspector; that before the card finds itself placed in the index of the fire chief, his inspector will make a visit to the building and see that the card has been properly prepared; that explosives are placed within easy access of door or window, so that they may be quickly removed from a burning building, and that dangerous weights will, where feasible, be carried by additional supports. The building and factory inspectors will also vise their copies of the card, and the facts therein given may lead to a more particular inspection of the building if there is evidence of overloading or liability to excessive vibration from the machinery it contains. It is further suggested that this index be revised at least every six months and at other times when there are considerable alterations in the building or in the disposition or weight of its contents. The placing of the plan at the main entrance, with the date of its preparation upon it, would render it open to the inspection of the police force, who would report any delinquency in the semi-annual renewal of the plan; it would also be open to complaints from employes who felt the facts were not correctly shown, and last, but not least, would be accessible on the arrival of the brigade. The home of the fire department's card index, however, might very well be in drawers in the vehicles of the district captains, so that when the captain arrived at a fire and while his men were raising ladders and connecting hose to the hydrants, he would have thirty seconds in which to pick out and survey the card in case he did not find it at the entrance of the burning building. As the face of these cards would have simply the diagram, with its conventional signs as regulated by the department, and marginal notes of the simplest, he would get all the main facts at a moment's glance. On the back of the card there would be printed a form to be filled up, which would contain all other information that he might be anxious to know, such, for instance, as the position of the nearest hydrants, whether the water tank has independent supports or otherwise, whether the hoist has fireproof walls and doors, and other matters that he might be most anxious to know about. This information on the back of the card would be always in the same order, the cards being provided by the fire department, with a sheet of instructions for their proper preparation. Very large buildings might require large cards, folded, however, to the adopted index size. Fire chiefs would become so intimate with such a card that they would read its contents almost as quickly as they would the face of an ordinary playing card. With such information before him, a fire chief could marshal his men to the best advantage in their fight with the flames and in their salvage of life and property, and at the same time could avoid the accidents which so often befall firemen in the exercise of their duties through the falling of heavy weights from upper floors, by asphyxiation by gas, by explosion, or by electrocution.

Fire Alarm for Small Town Sounded from Telephone Station.

An improvement in the manner of ringing the fire alarm has been inaugurated by Mayor Brinkman, of Warsaw, Ill. A solenoid has been installed in the central office of the Mississippi Valley Telephone Company, and by simply turning a switch the operator releases a thirty-pound hammer in the tower of the City Hall, a block away, which strikes the bell, making an alarm many times louder than by ringing the bell with a rope.

Crawfordsville Water and Gas Company Purchases Old Mains of Indiana Lighting Co.

The Crawfordsville Water and Gas Company has a clear field now, as it has secured all the old mains and other fixtures by a recent deal. The old gas mains were owned by the Dietrich syndicate until a year or so ago, when they were taken over by the Indiana Lighting Company. This company took over the property in this city, Lebanon, Frankfort, Thorntown, Darlington and other points from the Dietrich system.

The Street-Wykes syndicate, of New York City, controls the Crawfordsville Water and Gas Company, the water works plant of Shelbyville and the artificial gas plant at Warsaw, besides plants at other points. By the terms of the deal the Indiana Lighting Company gets a small interest in the Crawfordsville Water and Gas Company, which is capitalized at $200,000. There are eighteen miles of the old gas mains in the city, which the local company secures by the deal.

Public Ownership Profits in an English City.

Consul Albert Halstead reports that the profits on the gas, street railway and electric supply departments of the English city of Birmingham for the year ended March 31, 1910, aggregated $562,845, an increase of $23,242 over the previous municipal year.

Of these profits the gas department contributed $352,787, an increase of $5,027 over 1908-9 and $54,403 over 1907-8. The street railway department contributed $160,180, an increase of $17,000 over 1908-9, and despite the fact that by shortening the hours of motormen, conductors and other employes the wage cost was increased by about $38,932. The electric supply department contributed $49,882, an increase of $1,182 over 1908-9.

These net profits are allotted for the reduction of taxation, and the profit is

only regarded as net after sufficient sums have been set aside for depreciation, reserve and repayment of capital borrowed. The gas department, in addition to its contribution of $352,787 for the relief of taxation, contributed $19,466 to the city and $54,641 to the public lighting in the city, making its total of actual profit above all expenses for supplies, wages, maintenance, depreciation, etc., $425,889.

The returns from other departments of the city, such as water, markets, etc., are not in, but as the water department, by reason of the great cost of construction, is a constant charge on the city taxes, the net profit on all city business undertakings will be reduced to about $146,000.

Advancement of Ornamental Street Lighting.

During the past month a marked advancement of the cause of good street lighting has been apparent. The cluster system adopted in Indianapolis, which was described in the July issue, has been further extended. An accompanying photograph shows the excellent effect obtained upon Washington street in that city.

ILLUMINATION OF WASHINGTON STREET, INDIANAPOLIS.

Among the cities that have installed this "Great White Way" system during the past month are Niagara Falls, N. Y., Oklahoma City, Okla., and South Bend, Ind., while Germantown, Pa., Fargo, N. D., Richmond, Va., Atlantic City, N. J., Syracuse, N. Y., Rockford, Ill., and Ocean City, Pa., are among the cities that have adopted the plan and will soon be numbered among those that are advancing the cause of better public lighting.

Ancient City of Tarsus Illuminated by Electricity.

The ancient city of Tarsus, in Asia Minor, where the Apostle Paul was born and which was a great seat of learning at that time, is catching up with the progress of civilization, and is now illuminated by electricity. Consul Edward Inathan, of Mersine, in a report to this government on the electrification of the ancient city, says that the power is taken from the Cydnus river. There are now in Tarsus 450 electric street lights and about 600 incandescent lights for private use. It is proposed to extend the lighting system to Adana and Mersine.

Pasadena's Lighting Issue.

Although running at only half its total capacity, the municipal lighting plant of Pasadena, Cal., clears expenses, takes care of interest and sinking fund, and puts aside what its engineers claim is sufficient for depreciation. This is done on a 7-cent rate. The city now proposes that if it can secure about 40 per cent. more patrons, it will cut its rate to 5 cents. It offers a three-year contract, with further provision for cutting if the city sees fit. The Edison Company, the same one that supplies Los Angeles with light at a 7 to 9-cent rate, offers Pasadena a 4-cent rate. This is noteworthy inasmuch as Los Angeles is a much larger consumer than is Pasadena. It is clearly a competition between the Edison Company and the corporation of Pasadena, and the outcome is a matter of doubt.

Enlargement of Municipal Gas Plant at Westfield, Mass.

A short time ago the town of Westfield, Mass., expended about $25,000 in erecting a new gas holder, bringing the capacity of its gas plant up to 75,000 cubic feet of gas a day. The present plan is to increase the capacity from 75,000 to 125,000 cubic feet a day. The sum of $15,000 has been set aside for the proposed work. The additions will consist of enlarging the building, the buying and installing of new benches and new gas manufacturing machinery.

Investigation of Washington Gas Cost.

An investigation of the affairs of the Washington Gas Light Company is necessary, according to a report submitted to the Senate March 14, in order to enable Congress to fix intelligently a proper price for gas sold in the District of Columbia. The report states that the reasons for the resolution are as follows:

1. The Washington Gas Light Company, being a creature of Congress, Congress is responsible for its behavior. In order to discharge this responsibility Congress should know all of the facts incident to the business of the company, its capitalization, the extent and value of its service to the public.
2. Such information is not obtainable from the annual reports of the company made to Congress.
3. The act of 1848 limted the authorized capital stock of the company to $50,000, which has since been increased to $2,600,000, some of which, it is claimed, is without legislative sanction.
4. The company has outstanding certificates of indebtedness equal to its capital stock, to-wit, $2,600,000, bearing 6 per cent. interest, all of which, it is claimed, is wholly unauthorized by law.
5. It is impossible for Congress to determine what is a reasonable charge for gas unless Congress shall first know the value of the plant, the amount actually invested, and the cost of production.

The report continues:

From the legislative history of the company since its charter was granted in 1848, it is clear—

First, that the capitalization of the company is within the control of Congress.

Second, that the company has accepted such authorizations as Congress has given it, and has acted thereunder.

Third, that the company availed itself of that portion of section 5 (since repealed) of the 1896 act authorizing it to convert certificates of indebtedness in the sum of $600,000 into capital stock.

Fourth, that the certificates of indebtedness were issued without any express authority of law; their validity and so much of the capital stock as they represent is therefore open to serious question.

Fifth, if certificates of indebtedness represent no actual indebtedness due from the company, but, in fact, represent earnings and profits, they operate as an unauthorized increase of capital stock in violation of law.

Sixth. It is obvious that Congress never intended the company should have power to issue any certificates of indebtedness.

Congress, in all of the legislation referred to, has asserted its control of the capital stock issued by the company, manifestly for one purpose, that purpose being to protect the public against extortionate charges for gas based on an excessive capitalization. If an investigation shall develop that the $2,600,000 evidenced by certificates of indebtedness bearing 6 per cent interest, in fact, represent in any sense a valid indebtedness, it is clear the public has been wronged. Such wrong cannot be remedied by Congress unless and until Congress first ascertains the truth about the actual consideration for such certificates.

The report states that the original act of 1848 was silent on the subject of gas prices. This act of June 25, 1860, was the first attempt of Congress to fix the price. The price was made at 35 cents per hundred cubic feet, subject to discount at 10 per cent. if paid at a certain time. The act of 1862 fixed the price from July 1, 1862, at 28 cents per hundred cubic feet of gas furnished to the government and 30 cents to other consumers. The act of January 30, 1865, repealed the acts of 1860 and 1862, prohibiting the company from receiving on and after December, 1864, a greater price for gas than 40 cents per hundred cubic feet, subject to a 10 per cent. discount on all government bills, and 5 per cent. for all other consumers. The act of June 23, 1874, fixed the price of gas at the rate of $2.50 per thousand cubic feet furnished the government, and its other consumers, $2.75 per thousand feet. The act of June 6, 1896, fixed the price of gas for the Washington Gaslight Company at a rate not to exceed $1.10 per thousand feet until July 1, 1901, and after that at $1 per thousand cubic feet. The company ras recently reduced this rate to 90 cents per thousand cubic feet, if paid at a certain time, but raised the rate to $1.10 if not paid then, in clear violation of the law. Continuing the report says:

The last annual report of the company, made to Congress February 1, 1910, purporting to give a detailed statement of its business for the year ending December 31, 1909, shows the net earnings, after deducting operating expenses, to be $640,631.50. This was 12 per cent. plus on capitalization of $5,200,000, assuming the certificates of indebtedness to be a part of the capitalization. If we exclude the certificates of indebtedness, a net earning of 24 per cent. plus on the actual capital stock is reported by the company. It goes without argument that such a net income is excessive unless the facts shall disclose that the actual value of the plant and the actual amount invested is far greater than its capital stock. On page 2 of the report it appears that what is called "a regular" dividend of $260,000 had been paid the stockholders, also, an "extra" dividend of $260,000, or, in all, 20 per cent. paid in dividends during the year. In addition to these dividends the company expended $203,524.06 in extensions, constructions, etc., and had left a surplus of $238,355.03.

Waste in Unredeemed Cement Sacks.

During the months of March and April the Universal Portland Cement Company used about 3,000,000 cloth sacks in excess of the number returned by customers for credit. For these sacks the company pays at the rate of 10 cents each, which means that their customers have $300,000 coming to them from this source. Another interesting feature of the matter is that while the company carries a tremendous reserve stock of empty sacks, the largest stock could not be expected to stand a drain at the rate of 1,500,000 a month for any considerable length of time.

SEWAGE AND REFUSE

Public Comfort Stations in Indianapolis, Pasadena, Dresden—Springfield, O., Sewerage—New York Garbage Disposal Law—Cost of Street Cleaning—Columbus Garbage Reduction

Indianapolis Public Comfort Station Opened.

It is estimated that nearly 2,000 persons made an inspection of the Indianapolis public comfort station on the opening day, July 19. A description of the station is given in the July issue of MUNICIPAL ENGINEERING. The station, completed, cost approximately $17,000. Stilwell & Co., of Lafayette, contractors, had the contract. An appropriation of $20,000 was made for the completion of the work. The station will be in the charge of two men and two women from 7:30 o'clock in the morning until 11:30 o'clock at night.

Pasadena's Novel Public Comfort Stations.

Along the line of the public comfort station of Indianapolis, mentioned in the July number of MUNICIPAL ENGINEERING, Pasadena, Cal., has a system which differs from that of Indianapolis, in that private stations are maintained. Some of the leading merchants of the city have agreed to maintain such stations for the benefit of the public. The location of these will be indicated by a red cross within a green circle, with the letters M and W, for men and women, respectively.

Mr. A. C. Shover, plumbing and building inspector of Pasadena, has been largely instrumental in bringing about this public sanitary advance, and over thirty merchants of the city have lent their practical aid to the proposition.

Dresden's New Public Comfort Station.

In the capital of Saxony, Dresden, a new type of public comfort station has lately been turned over to the public. The new type of station is a marked improvement over the old box-like structure, closely walled up and apparently without ventilation.

The station is a structure of stone, with a broad arcade-like front, supported by four heavy stone columns. The first floor is devoted to a florist's shop, a news stand, a public telephone pay station and toilet rooms, those for the men and women being on opposite sides of the building, with an attendant's room between.

On the lower, or basement, floors are public urinals and free washbasins. Automatic venders supply towels and soap. This room is not under constant care, but is washed and the brasses are polished every morning.

One factor that seems to have been improperly cared for is the matter of heating the station. The basement floor has absolutely no provision for heating, while the upper floor is heated by small coal stoves. The building is wired throughout for electricity, but gas is supplied only in the attendants' room, for cooking, and no provision is made for hot water at the lavatories.

The Sewerage System of Springfield, O.

Springfield, O., is at present engaged in the construction of 120 miles of sewer, to cost about $860,000. The separate system was adopted, owing to the excessive cost of rock excavation, which forms the great portion of the necessary excavation, and by reason of the fact that mechanical disposal is necessary.

The sewers are designed upon a basis of seventy-five gallons per capita daily and a population of 160,000, it being estimated that during the life of this system about two-thirds of the population will be connected with the sewers, and at the end of forty years they will run two-thirds full.

The city is divided into districts, each district being a small system by itself and having access to an intercepting sewer. In the residence portion of the city the sewers are mostly designed as vitrified pipe, 8 and 10 inches, depth 8 feet, with 6-inch house connections, based upon population of an average block which will remain constant throughout the life of the system. The system is self-cleansing, reinforced by flushing tanks at the upper end of the various laterals. One excellent provision in regard to the sewer construction is the requirement that laterals must be carried to the curb line of the street at each property at the time of constructing the main sewers. This method, if carried out in all underground construction work, would make possible a system of good roads and their easy maintenance. The flushing tanks are built underground, capacity 850 barrels, being connected with the city water mains, used at least once a month. This water is furnished free by the city at the present time. No storm water is taken into the sewers.

The system, as constructed to date,

cost $265,000, all built by contract labor, which, under severe competition, reduced the price of sewer construction to its lowest value. Mr. M. J. Bahin is chief engineer in charge of the work.

Cost of Street Cleaning.

The cost of street cleaning has been considerably discussed in Newark, New Jersey, during the last three or four months. As a result, statistics have been carefully gathered from nineteen municipalities covering every phase of street cleaning operations. On a population basis the city of Newark pays more than any of the nineteen cities for cleaning the streets, as the following table will show:

	Population.	Square Miles Territory.	Cost of Cleaning Streets.
Chicago.....	2,500,000	190½	$778,437.00
Philadelphia.	1,545,800	129½	1,199,000.00
St. Louis....	750,000	61 1-3	360,000.00
Boston	629,478	42 2-3	419,275.00
Pittsburg ...	580,000	41	399,353.00
Cleveland ..	525,000	45	192,000.00
S. Francisco.	500,000	43	252,900.00
Cincinnati ..	460,000	43½	169,200.00
Detroit	450,000	40	172,246.83
Buffalo	425,000	42	141,189.97
Milwaukee .	400,000	22¼	160,000.00
New Orleans	375,000	192	199,488.00
Washington.	345,000	69¼	213,990.00
Newark	320,000	23	295,220.67
Minneapolis..	300,000	53¼	79,320.00
Louisville ..	253,000	...	206,000.00
St. Paul ...	235,000	55½	72,320.00
Providence .	215,000	18¼	80,425.00
Rochester ..	210,000	...	94,790.00

On the basis of the miles of paved streets cleaned, however, the statistics from the cities show a comparison that may be considered fairer, which are as follows:

	Miles of paved sts.	Total cost.	Cost per mile
Cincinnati ...	476	$169,200.00	$355.51
Buffalo	361	141,198.97	391.11
Detroit	358	172,246.83	481.12
Chicago	1,614	778,437.00	482.30
Rochester ...	178	94,790.00	532.53
St. Louis.....	589	360,000.00	611.21
Minneapolis .	126	79,320.00	629.52
Cleveland ...	300	192,000.00	640.00
San Francisco	357	252,900.00	708.40
Washington .	289	213,990.00	740.45
New Orleans.	268	199,488.00	744.32
Pittsburg ...	500	399,353.00	798.70
Boston	514	419,275.00	815.71
Philadelphia.	1,365	1,199,000.00	878.40
Louisville ...	195	206,000.00	1,056.41
Newark	201	295,220.67	1,468.76
St. Paul	48	72,320.00	1,506.66
Providence ..	46	80,425.00	1,726.63
Milwaukee ..	80	160,000.00	2,000.00

Legislation Regulating Garbage Crematories.

Crematories for the disposal of garbage within ten miles of the corporate limits of any city in the state of New York are to be operated in the future, with such appliances and methods as to prevent offensive and noxious gases and fumes arising from the treatment of garbage, offal, dead animals or fish. A private corporation or a municipality operating any such crematory which allows or permits such a nuisance is deemed guilty of a misdemeanor, punishable by a fine of not less than $100 or more than $250 for each day that the odors are permitted to exist, or by imprisonment for not more than one year, or both. The new law takes effect on September 1.

The Municipal Garbage Reduction Plant at Columbus, O.

On Wednesday, July 20, 1910, the new garbage reduction plant at Columbus, O., was put in commission and started off smoothly at a very leisurely rate, as the capacity of the plant is 80 tons of garbage a day and at the beginning but half this capacity will be required, or even less during the period of getting the new municipal collection system in operation.

A number of new steel wagons with tarpaulin covers have been purchased and put in service to collect the garbage and deliver it on Mound street at the canal, where it is dumped into special compartment steel cars and hauled by the Hocking Valley railroad over the city's own railroad to the reduction plant, which is located next to the sewage disposal works, about 1½ miles south of the city limits.

The cars are run into a small building at the plant, the track being several feet above the level of the ground. Here they are dumped down a sloping concrete surface onto a slightly sloping floor. On this floor the tin cans, bottles, and other materials objectionable to the subsequent processes are picked out, and the garbage is shoveled into a channel alongside the floor. In this channel runs a conveyor designed and built by the Jeffrey Mfg. Co., of Columbus, the vanes of which draw the garbage through the trough in the small building, up an enclosed inclined trough leading to the top of the main building and thence along a horizontal trough over the six garbage cookers, into any one of which it is dumped by opening a slide in the bottom of the trough. The garbage, somewhat dried during the process of picking over and conveying, drops through the hole and slides down a steeply inclined chute into the open top of the tank being filled. The chute is revolvable so that it can reach several of the cooker tanks in turn.

When a tank is filled it is tightly closed and steam is turned in for sufficient time to remove the grease from the garbage. The tank is then cooled off and allowed to settle until the solid matter drops to the bottom and the oil rises to the top. The oil is then drawn off into the system of separating and purifying tanks for further preparation for market. The water is drawn off into a large tank and thence to an evaporator made by the Zaremba Co., of Chicago, which reduces it to a consistency something like molasses, called "stick," any remains of oil or grease being drawn off. The solid matters are dropped out of the

bottom of the tank into an Edgerton roller press made at Kutztown, Pa., where the water remaining in it is pressed out and transferred to the water purifying system. The dried and pulverized "tankage" is dropped into a conveyor, which carries it to and dumps it near a large tank into which it is shoveled and mixed with the "stick," and is then ready for sale to the manufacturers of fertilizers.

The plant is almost wholly automatic in its operation, the only hand labor being used in picking the inorganic refuse out of the garbage and shoveling the latter into the conveyor trench, and in handling the tankage at the mixing tank. These are the only points at which the operation of the machinery cannot be continuous and there is consequent danger of congestion, or where the separation cannot be automatic.

The plant was designed by chief engineer Osborn, who is a "graduate" from the Toledo reduction plant. He was in charge of its construction and will be in charge of its operation until everything is in complete and smooth running order.

The writer visited the plant during the morning of the first day of operation when two of the cooker tanks had been filled and steam turned on and a third was filling, so that the subsequent processes and the machinery for them had not yet been tested. The process is a closed process except the picking over of the garbage and the long distance it is conveyed to the cooker tanks, and also the conveying of the tankage from the press to its dumping place and the shoveling of the same into the mixing tank. This reduces the danger of nuisance to the odors from these two masses of material, which are of comparatively low temperature. The scattering of odors from the raw garbage would be less if it were dumped at the cookers, but there are some disadvantages about the latter plan. Whether they outweigh the greater danger of nuisance from the drying garbage during the rather long distance it is conveyed from the dump house below to the cooker floor above must be settled to some degree by experience. The same may be said of the rather warm tankage if it is not handled promptly at the mixing tank.

Statements of the cost of the plant vary somewhat, but approximately the buildings seem to have cost $100,000, the complete equipment of machinery $150.-000 or $250,000 for the reduction plant and, with the collection plant added, $290,000 for the whole system.

The tin cans will be pressed in bales and sold. The bottles will be sold or used for filling with other refuse. Combustible and comparatively innocuous refuse is not cared for by the present system and the problem of its collection and disposal must be worked out later.

STREETS AND HIGHWAYS

Cement Streets—Cement Macadam—Prizes for Maintenance—Venezuelan Asphalt—Brick Pavement Inspection—Denver Asphalt Plant

Fond du Lac's Cement Streets.

In a paper given before the League of Wisconsin Municipalities, City Engineer J. C. McCullogh, of Fond du Lac, gave a detailed discussion of "Cement Streets." In speaking of them he says:

The city of Fond du Lac has had the ordinary experience of cities of its age and size. It has had the graveled road, the plank road, Nicholson block and cedar block, and we now have common macadam, bituminous macadam, asphalt, brick and concrete streets. The past three years we have built principally concrete pavements. We do from $90,000 to $100,000 worth of this class of improvement work a year, about 20 per cent. of the cost of which is paid from the general fund and balance by abutting property.

The concrete pavement is not claimed to possess all good features and no faults. As we build it we have been trying to build a cheap pavement, and we claim for it cheap first cost, ease of traction, that it will stand the wear from automobile traffic, that it is easily cleaned, and is sanitary, not more slippery than brick or concrete block, and we hope it will not cost much to maintain. Its one fault that we acknowledge is its tending to crack from contraction.

To try to overcome the contraction crack that first appears longitudinally in center of pavement, we are this year building about 1½ miles in which we put a wire mesh reinforcement in the concrete. If the pavements continue to crack to such an extent as to render resurfacing necessary in the course of eight or ten years, I see no reason to prevent us putting on an asphalt wearing surface.

My theory is that the pavement expands all right without any bad effects, but when contraction sets in, the mass will not hold together, to creep back up over the crown of the street, and that in reality the pavement creeps down hill, or toward the curb, both in expanding and contracting. We put in a very little crown on that account.

For the amount and kind of traffic on

THE SPEEDWAY, INDIANAPOLIS.

Cement Filling Completed. Removing Board to Make Expansion Joint.

the majority of the streets in a city of this size, the cement pavement is a good enough pavement, and is as good value at its price as one of the higher grade pavements would be at the price they cost.

I have compiled some figures to show you the cost of our work to date:

In 1908 were laid 1¼ miles, requiring 14,732 yards, at an average cost of $1.32½.

In 1909, 3 8-10 miles, or 69,197 yards; average cost, $1.23½.

In 1910, this season, we built and have under contract, 3½ miles, or 55,394 yards, at an average cost of $1.16½, including about 1½ miles of reinforced pavement, the average cost of plain concrete being $1.10.

At the end of this season we expect to have sixteen concrete streets, comprising eight to ten miles, at an average cost of $1.21.

Cement Filled Macadam Road in Wayne County, Indiana.

One of the biggest gravel road contracts ever awarded under Indiana's three-mile road law was let July 11 to John F. Cronin & Co., of Richmond, Ind., the contract price being $52,000 for the road proper and approximately $2,500 for a dressing of asphaltic cement, to be used on that section of the road within the city of Richmond. The road to be improved is the historic National road, from a point in West Richmond to the boundary line of Center township, a trifle less than three miles west of Richmond.

The stretch of road to be constructed here will be wholly unlike any other highway in the state. Cement curbs and gutters will flank the roadway its entire length. The road itself is to be constructed of crushed stone, with cement filler, and the whole is to be pressed into a solid mass with ten-ton road rollers. The width will be forty-five feet.

Prizes for Road Maintenance.

The Chamber of Commerce of Quincy, Ill., have offered gold prizes aggregating $630 for the best strip of dirt wagon road. The road must be kept in condition with a split log drag or similar device, and the competition covers the period from July 1, 1910, to May 31, 1911.

Increased Output of Venezuela Asphalt.

It is expected, according to reports received from the United States minister to Venezuela, that the asphalt shipped from Guanoco will this year reach an amount in excess of 40,000 tons. Guanoco is a little inland town of 200 population, and is reached by boats up through the gulf of Paria and the rivers of San Juan and Guanoco. The asphalt deposit is about five miles from the nearest river point, and the asphalt is carried across country by a small narrow-gauge railway.

The Inciarte deposits will export a less amount, owing to the greater difficulty of transportation. A railway twenty-seven miles in length is necessary to transport the product of the Inciarte deposits to the nearest navigable water, the Limon river, and from here the asphalt must be carried in small boats to Maracaibo lake. This double handling makes the development of the Inciarte regions less rapid than might otherwise be expected.

Denver's Municipal Asphalt Plant.

Denver's municipal asphalt plant will commence operations on August 1, after which time all asphalt cement used in street repair and resurfacing will be manufactured by the city. It is the intention, if the project proves a success, to enlarge the plant so as to furnish asphalt cement for all new streets, but at present the repair work is all that can be handled.

The new municipal undertaking has cost to date approximately $25,000, of which $7,500 was expended for the site and $17,150 for the buildings and machinery. The buildings are of steel and cement and are fireproofed throughout. The capacity is 1,000 square yards of 2-inch surfacing per day. The raw material to be used at the Denver plant is taken from the asphaltic base oils by a process of distillation, which draws off all water, gasoline, kerosene and the lighter oils, leaving a heavy residue which in the case of California and Texas oils is 99 per cent pure asphalt bitumen.

Mr. S. R. Murray, who supervised the construction of the plant and who is to have charge of its operation, was formerly superintendent of the Indianapolis plant and has had seventeen years' experience in the asphalt business. He estimates that the plant will pay for itself in two seasons.

Indianapolis, Detroit, Columbus and Dayton are among the cities that have established asphalt works and demonstrated their practicability. Winnipeg and Hamilton, in Canada, have asphalt plants that not only furnish material for repairing the streets but also for laying original paving in lieu of by private contract work.

An Official Inspection of Brick Pavements.

During the four days beginning July 18 a large committee of municipal officials and others inspected brick pavements and brick roads in Indianapolis, Marion county, and Terre Haute, Ind., Cincinnati, Columbus, Cleveland and Cuyahoga county, Ohio, upon the invitation of the National Paving Brick Manufacturers' Association, extended through Will P. Blair, their efficient secretary. The invitation included the committee on standard specifications of the American Society of Municipal Improvements, of which three of the five members responded, viz., Charles H. Rust, chairman, city engineer, Toronto, Ont., Edwin A. Fisher, city engineer, Rochester, N. Y., and Charles C.

SOUTH SIXTH STREET, TERRE HAUTE, IND.

Cement Filler, Eighteen Years Old. Smooth Pavement With Perfectly Filled Joints.

Brown, consulting engineer and editor of MUNICIPAL ENGINEERING, Indianapolis, Ind.; the committee on brick paving of the Organization for Standardizing Paving Specifications, of which a majority responded, viz., E. H. Crist, chairman, commissioner of public works, Grand Rapids, Mich., Donn M. Roberts, vice chairman, city engineer, Terre Haute, Ind., John B. Hittell, chief engineer, department of streets, Chicago, Ill., Henry Maetzel, city engineer, Columbus, O., and Henry W. Klausmann, city engineer, Indianapolis, Ind. Other invited guests for more or less of the trip were H. G. Hawekotte and J. H. Deane, assistant city engineers, Indianapolis; Prof. I. O. Baker, of Illinois University, Champaign, Ill.; Prof. F. H. Eno, of Ohio State University, Columbus, O.; Prof. E. D. Rich, of University of Michigan, Ann Arbor, Mich.; Harry B. Smith and T. A. Randall, of the technical press in Indianapolis. The party was well taken care of by W. P. Blair, secretary, M. W. Blair, W. T. Blackburn, Merle Sidener and local representatives of the paving brick interests in each of the cities visited. The engineering departments of all the cities were untiring in their service as guides and instructors regarding the pavements included in the itineraries.

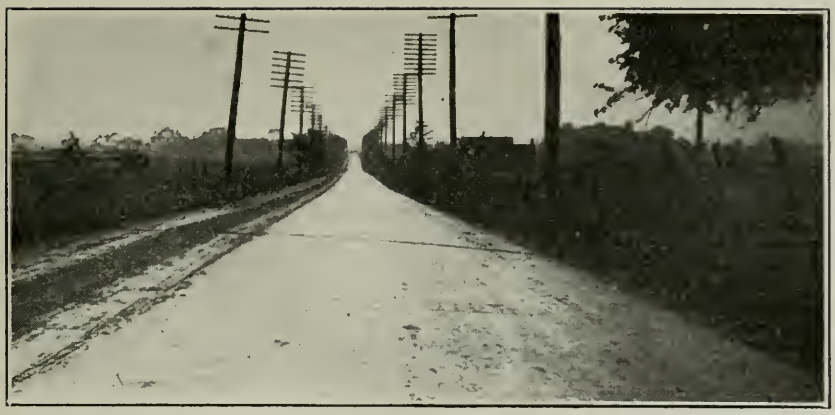
THE INSPECTION PARTY ON LAKE SHORE BOULEVARD, CLEVELAND, OHIO.

The famous Speedway at Indianapolis received the first visit. This track, 2½ miles long, was paved last year with Culver blocks, laid with cement filler, according to the specifications recommended by the National Paving Brick Manufacturers' Association, except that the foundation is the old, well-compacted bituminous pavement instead of a new concrete layer. This pavement is an object lesson as to how to build a pavement. It is but a year old and subject to automobile traffic only, and shows no wear, and also no effect of weather conditions. Some excellent pictures of it will be found in vol. xxxvii, p. 348, and one showing removal of board to put in expansion joint is shown herewith.

At Terre Haute a number of pavements with cement and bituminous fillers were seen, showing the effects of good and poor workmanship and materials. The most notable pavements were a part of one on Wabash avenue, accidentally laid some eighteen years ago according to the present best method with cement filler, and South Sixth street, laid shortly thereafter according to a carefully devised specification which has been closely followed, with a few improvements, in all the best work since that time. These streets are smooth and the joints are filled full of cement and wear uniformly with the rest of the street, so that there is none of the rattle of traffic which comes from badly filled joints and rounded tops of bricks. The South Sixth street pavement is shown in an accompanying photograph.

Cincinnati had little to show in the way of smooth brick streets, though some, particularly of the later contracts, were well laid and promise long life, though comparatively noisy.

Columbus was in similar condition, except that most of the streets, whether new or old, were in good general condition and showed excellent workmanship and materials except so far as the failure to



SCHAAF ROAD, CUYAHOGA COUNTY, OHIO.

FISHER ROAD, CUYAHOGA COUNTY, OHIO.

KINSMAN ROAD, CLEVELAND, OHIO.
Brick Between Street Railway Tracks. Expansion Joints Every 100 Feet.

fill the joints with permanently solid filler is concerned.

Cleveland apparently learned a dozen years ago to make smooth brick streets by filling the joints with a permanent material, which adheres to the bricks and wears uniformly with them. Cuyahoga county also learned the lesson some years ago, and brick roads laid in the last eight or ten years show the same smoothness of surface and retention of filler in the joints that is so noticeable in the Terre Haute pavement. When the method was demonstrated to be correct it was followed, and consequently Cleveland and Cuyahoga county both boast of several hundred miles of smooth brick streets and roads. The city has some poor brick streets also, and the county has some poor brick roads, but the proportion of poor roads laid since about 1902 is very small.

A fuller description of the Cuyahoga county roads will be given later, space preventing at this time. It must suffice for the present to show photographs of Schaaf and Fisher roads. Schaaf road is 3.16 miles long, of brick, 14 feet wide, on 6-inch slag base, with stone curbs, a few hundred feet on a steep hill being of Medina stone, 8-inch blocks, 18 feet wide. The total cost per mile was $22,425. This road was two years under construction, and was completed in November, 1907. Fisher road is 3.31 miles long and 14 feet wide, has concrete base and stone curbs, and cost $20,664 a mile. It was built in 1908. Both these roads have cement filler in the joints and are in excellent condition.

Another of the accompanying photographs shows Kinsman road, in the city of Cleveland. This is a bitulithic street, with brick laid in the street car tracks. Concrete foundation under tracks and pavement and cement filler show a smooth street. It was thought desirable to put cross expansion joints every 100 feet in the track, and these joints were made by filling with tar three or four wide joints between bricks. These joints are a source of weakness in the pavement, for the excess of expansion in the upper sides of the bricks and the squeezing out of the filler have caused the upper sides of the bricks in the two or three rows with soft filler to be pinched by the expansion of the hundred-foot sections of pavement between expansion joints, and these surfaces have spalled to a considerable extent. This experience is quite different from that reported by Mr. Kingsley at Little Rock. However, the pavement is older, and this concentration of effect on a few soft joints is very evident. The bricks are also doubtless much harder.

One photograph shows Jennings avenue which has a sufficient concrete pavement under street railway tracks to keep the surface in good condition.

A small photograph shows the inspection party on the Lake Shore drive, including the gentlemen named above; Mr. Bayne, Cleveland's engineer of streets; Mr. Barber, Mr. C. C. Blair and Mr. Duty, representing the local brick manufacturers, who supplied much of the material for both city streets and county roads.

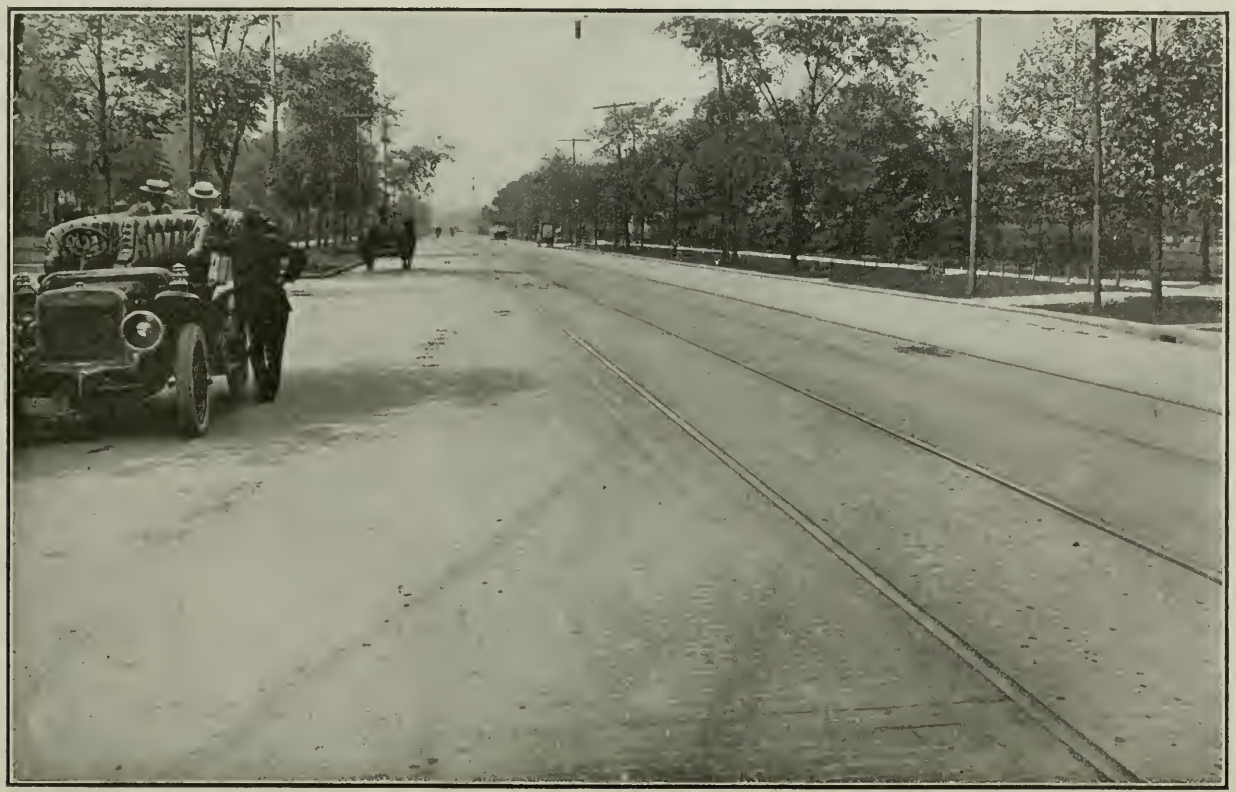
The members of the committees expressed their thanks for the information gathered, and stated that it would materially aid in their work for their respective organizations. The questions arising were thoroughly discussed and the results will be reported from time to time in detail, which is impossible in this article.

The Possibilities of Mathematics.

MUNICIPAL ENGINEERING is doubtless within the bounds of propriety in inserting the following extract from *Harper's Weekly*, taken by a subscriber from the pages of a Sunday school magazine, as a demonstration of the capacity of the mathematical imagination stimulated by recent events in the theatrical world: "In the ballroom of the Hotel Naftaftia, during Christmas week, William R. Spriggs, Ph. D., held a number of fashionable audiences spellbound with his marvelously lucid dances in Euclid and algebra up to quadratics. Perhaps the very acme of terpsichorean art was attained in the masterly fluency of body and limbs by which Mr. Spriggs demonstrated that the sum of all the angles of a triangle is equal to two right angles. In Pittsburg Mr. Spriggs is said to have moved an audience to tears, when, by an original combination of the Virginia reel, the two-step and the Navajo snake dance, he showed that if $x^2+y^2=25$ and $x^2-y^2=25$, $x=5$ and $y=0$. All the pride and selfishness of x, all the despair of y, were mirrored in the dancer's play of features."

National Park at Washington's Crossing of the Delaware.

The Washington's Crossing National Park Commission effected an organization May 27. The commission consists of 50 persons appointed by Governor Fort of New Jersey under an act of last winter. The law creating the new commission provides that it shall have power to acquire and make available for use as a public park such lands as it may locate at Washington's Crossing, as a memorial of the crossing of the Delaware at McConkey's Ferry by General Washington and the Continental troops.



JENNINGS AVENUE, CLEVELAND, OHIO.

Concrete Foundation Under Pavement and Tracks, and Cement Filler.

MUNICIPAL AND TECHNICAL LITERATURE

Springfield, Mass.—London, Ont.—Birmingham, Ala.—Cincinnati, Ohio—Cambridge, Mass.—Books for Engineers

Sewer and Paving Work in Springfield, Mass.

The report of the city engineer of Springfield, Mass., for 1909 contains a detailed account of paving and sewer work under the day labor system; the supervision being in charge of the street and engineering departments. About 12,500 square yards of concrete base, wood block pavement was laid at an average cost for all labor and materials of $3.29 per square yard. Treated gum blocks at $2.10 per square yard were used.

Concrete was used for the construction of all sewers over twenty-four inches in diameter, and collapsible steel forms were used in their construction. All the work was done by day labor.

Pavement Work in Cambridge.

The commission appointed by the city of Cambridge, Mass., to report upon the matter of developing and improving the city of Cambridge, has made a preliminary report, the substance of which is given in the following table.

Pavement Proposed	Name of Street	Location of Improvement	Length	No. of sq. yds.	Estimated Expense	Pavement Recommended
Granite	Charles	3rd to 6th	1170	4369	$14,000	Granite Block
Wood	Prospect	Central Sq. to Austin St.	330	854	1,800	Creosoted Block
Granite	Albany and Erie	Pacific St. to Waverly St.	1150	4200	13,000	Granite Block
Brick	Putnam Av.	River to Mt. Auburn St.	2840	9075	25,000	Brick
Bitulithic	Mt. Auburn	Sparks to Coolidge Av.	2500	11000	25,000	Bitulithic
Bitulithic	Mass. Av.	Sacrameto St. to Waterhouse St.	1700	10580	24,000	Bitulithic
		Total	9690	40078	$202,800	

Paving and Sewer Work in Birmingham.

Birmingham, Ala., is engaged in putting through about $250,000 worth of paving this summer, in addition to about $250,000 worth of sewer work which is just being completed. The paving work includes 42,350 square yards of bitulithic pavement, to cost the property owners about $1.85 per square yard; 9,600 square yards of brick pavement, to cost the property owners $1.90 per square yard, and 38,750 square yards of bituminous binder pavement. Of the latter class, which is being constructed for light traffic, 19,050 square yards is to cost 65 cents per square yard, and the other 19,700 square yards is to cost only 52 cents per square yard. The reason for the extreme cheapness of the last named division is due to the fact that city prison labor is to be employed.

Cincinnati Water Works.

In a report submitted to General Superintendent Laidlaw, of the Cincinnati water works, by Operation Superintendent Pollard, the latter asks for an appropriation of $60,000 to replace twelve boilers at the main pumping station. The boilers are said to be inadequate, and it is necessary to operate them at a steam pressure approaching the danger limit.

Mr. Pollard also recommends the universal adoption of meters in an effort to prevent the unnecessary waste of water. He calls particular attention to the fact that the pumpage has increased nearly 12½ per cent. over that of the corresponding months of 1909.

Making the water do some work which will save the city money is outlined in a suggestion of Pollard that the water power, estimated at 200-h.p., in the fall of water between the settling reservoirs and the coagulation basins, be utilized for generating electric current.

Water Meters in London, Ont.

The commissioners of London, Ontario, have been able, as a result of adopting

meters for the water supply, to reduce prices as much as 50 per cent. The rental of all meters up to one inch has been cut in half, while, at the same time, the minimum price of the water has been reduced. Chairman McMahon is of the opinion that if meters had been adopted earlier, the recent extensions to the water system would not have been necessary.

Books for Engineers.

Baldwin on Heating, or steam heating for buildings revised, being a description of steam heating apparatus for warming and ventilating large buildings and private houses, with remarks on steam, water, and air, in their relation to heating; to which are added useful miscellaneous tables. By William J. Baldwin, M. Am. Soc. C. E., and M. E. Sixteenth edition, revised and enlarged. Cloth, 404 pp., with many illustrations. $2.50. John Wiley & Sons, New York.

The first edition of this book was written in 1878, and it has been revised in 1897 and in 1908, being now brought down to date. It is a practical book, but little given to theory which cannot be applied directly to the practical work of the builder of heating systems for buildings large and small.

One chapter is devoted to the gravity circulation apparatus. The radiators and heating surfaces are considered in two chapters; boilers and their settings in five; various appurtenances, such as grates, chimneys, draft regulators, feeders, valves, piping, in sixteen; steam and its treatment in heating apparatus in ten.

The book will be found very convenient by the engineer wishing data for estimates as well as by the steam heating designer and contractor.

Solid Bitumens, their physical and chemical properties and chemical analysis, together with a treatise on the chemical technology of bituminous pavements. By S. F. Peckham, A. M., chemist to the department of finance, city of New York, member of American Philosophical Society, Society of Chemical Industry, American Chemical Society, American Institute of Chemical Engineers, etc. Cloth 324 pp., $5 net. The Myron C. Clark Publishing Co., New York and Chicago.

The author has had many years, about fifty, of experience with bitumens and has long been well known in the literature of the chemistry of bitumens. Some years ago he made some very valuable contributions to the discussion of the technology of bitumens in the pages of MUNICIPAL ENGINEERING.

After a brief historical introduction, the author gives a brief geographical classification of bitumens, with some reference to the geological ages of deposits. He summarizes the controversies over the origin of bitumens and concludes that various deposits have various origins and have been formed in various ways, all of which have been demonstrated more or less correctly and accurately by those engaged in the discussions.

The classification of bituminous substances is on the basis of bitumens, which include natural gas, petroleum, maltha, and asphalt; pyrobitumens, which include coal, bituminous shales and schists; and artificial bituminous substances which are direct products of the arts or by-products of manufacture. Evidently this is but one of several possible systems of classification. The title of the book limits the author to the consideration of the solid bitumens under his three classes.

There has been much controversy also over the derivation of bitumens and the author again sums up the contributions to the discussions, regarding the derivation of natural solid bitumens by evaporation, decomposition, and polymerization; of bituminous rocks; of artificial solid bitumens.

The second part gives a fairly satisfactory statement of the state of the chemical technology of bitumens, admitting in the first sentence that there are few subjects of equal importance about which chemists know so little. He begins with Boussingault's memoir of 1837, discusses with some warmth the use and misuse of the terms petrolene, asphaltene, retine, etc., and passes to the various analyses of solid bitumens. One chapter on the ultimate analysis refers to well known methods and gives the author's own methods for determination of carbon, hydrogen, sulphur, oxygen and nitrogen.

Another chapter on the proximate analysis gives methods of distillation, which are applicable but slightly to solid bitumens; methods of solution in carbon disulphide, petroleum ether, turpentine, chloroform and hydrochloric acid; with reference to Trinidad Pitch Lake of the gas, lake water, aqueous and alkaline solutions of the pitch; consideration of the residual organic and mineral matters.

The technical analysis is one in which comparatively little work has yet been done. It is considered in a chapter, giving methods of distillation and solution of other asphalts than Trinidad Lake, quoting the methods of other chemists and giving in detail the author's own recommending solvents of fixed purity, such as alcohols of at least 95 per cent. purity, acetone, ethyl ether, chloroform, and perhaps carbon tetrachloride and acetone. This discussion, he says, must be inconclusive, the field of chemical research in this line being a field as yet but little worked.

The modern problem for the chemist who is keeping track of the materials used in street paving is the distinguishing of solid bitumens in mixtures. The special chemical and physical methods of analysis by which this can be done are described in a chapter giving methods of determining fixed carbon, preparation of street mixtures for the determinations, tests with fuming sulphuric acid, alcohol and alcohol-benzine, the precipitation

method, determination of paraffine, distinguishing between artificial asphalts, the use of the microscope and spectroscope.

Analyses of asphalt blocks and concretes, creosoted and wood paving blocks are discussed in a chapter which also contains the various methods of chemical analysis of cements, limestones, cement mortars and concretes which are used in the foundations of bituminous pavements.

A third part of the book is given to the physical properties of solid bitumens, and explains the tests for specific gravity, softening point, melting point, flow, ductility and penetration.

The fourth part on the chemical technology of bituminous streets is not as satisfactory as the rest of the book and does no compare favorably with the chapters in the recent books on paving and paving materials on the same subjects, viz., foundation, asphalt surface, bitulithic, oiled roads and streets, asphalt blocks and wood blocks.

The chapter of conclusions lays down the requirements of a solid foundation; bitumen not acted on by water or protected from action by water; clean, dry, rough concrete surface; binder course one inch in thickness; sharp sand with proper proportion of fine sand, dust or Portland cement, bitumen selected for climate.

A Treatise on Concrete, Plain and Reinforced, materials, construction and design of concrete and reinforced concrete. With chapters by R. Feret, William B. Fuller, Frank P. McKibben and Spencer B. Newberry. By Frederick W. Taylor, M. E. Sc. D., and Sanford E. Thompson, S. B., Consulting Engineer. Second edition, total issue, 11,000 copies. Cloth, 847 pp., 249 plates and diagrams, $5. John Wiley & Sons, New York.

A full review of the first edition of this book was printed in MUNICIPAL ENGINEERING, vol. xxx, p. 61. The present edition is practically the same as regards methods of construction and examples of structures. It has been thoroughly rewritten as regards the theoretical discussions and the methods of design.

Since the appearance of the first edition there has been great activity in the study of concrete, and many laboratory experiments and actual structures have been made, which have very materially added to our information, especially regarding reinforced concrete work. Numerous engineers have devised new systems of reinforcing and have made great improvements in the application of the older systems, so that both theoretically and practically there has been great improvement in methods of design and construction. An enumeration of the improvements in this second edition of the book will be very nearly an enumeration of the advances in the theory of concrete and reinforced concrete.

The more general classification of fine aggregates and coarse aggregates is adopted. The treatment of methods of placing concrete, joints and surfaces is somewhat improved. Mr. Eckel's sub-classification of Portland cements as normal, low and high iron content is inserted. The water for concrete, compression strength, tests of sand, density of mortars and concrete, and experiments thereon, coarse and fine sand, dust, and other impurities in aggregates, filling voids with fine material, mica in sand, methods of proportioning concrete, by arbitrary selection of volumes, by void determination, by French rules, and as to amount of cement, mechanical analysis diagrams, mixing concrete, forms for mass concrete, effect of sea water on concrete and mixtures of puzzolan and slag with cement for use therein, fire resistance and protection of reinforcement from heat and rust, lime, clay, asphalt for making concrete structures waterproof, and other methods of affecting permeability, tests of concrete columns, concrete in shear, effects of oils and electrolysis on concrete, are some of the subjects in which progress is reported. The tables of quantities of materials in mortar are separated into two, one for ordinary coarse bank sand and one for very fine sand.

The principal additions to the book are in the chapters devoted to the theory of concrete design, particularly of reinforced concrete. These have increased the size of the book 81 pages in the chapter on reinforced concrete design, a new chapter on arches and some additional appendices, to which some of the demonstrations of formulae have also been transferred. These chapters have also been rearranged and the tables to which objection was made in the former review have been taken out.

The additions to the text of the chapter on design include discussions of the modulus of elasticity of concrete, elongation, quality of steel, formulae for designing rectangular beams, slabs, T-beams, beams with steel in top and bottom, continuous beams and slabs, formulae and diagrams for determining shear and bending moments, diagonal stresses and reinforcement therefor, stirrups, bond of steel and concrete, bends in horizontal reinforcement, spacing of bars, hooked bars, columns, temperature and shrinkage stresses. There are also examples of designs for beams, flat slabs, hooped and other columns. A dozen names are added to the list of systems of reinforcement. Tables are supplied for dimensions of bars and rods, for determining loads and stresses in supported and continuous beams, slabs, cinder concrete slabs, beams with steel in top and bottom and flat slabs, for reviewing designs, for the constant in formulae for depth and moment of resistance of beams, for effect of different percentages of reinforcement, for proportional depths of neutral axes. Diagrams for some of these tables are also supplied. The latest official recommendations for working stresses in reinforced concrete are given,

and the common formulae for beams, columns and reinforcement are collected at the end of the chapter.

The chapter on arches is a concise statement of the elastic theory and a simplified method of applying it to arch design, with an example occupying over 50 pages, with a half dozen additional pages on erection and showing notable arches.

The chapters on concrete structures, showing practice, are practically unchanged, the additions being theoretical discussions of the design of a reinforced concrete chimney, reinforced concrete foundations and footings, earth pressure, and reinforced concrete retaining walls of various forms of cross-section, conduits, and storage reservoirs. One chapter gives a list of a dozen or more prominent special uses of concrete.

The new references to books and articles on concrete are added to the various lists, so that the new list is distinguished from the old, and, in addition to its convenience, shows graphically the relative amount of discussion of the various subjects heading the lists.

The partial reference indexes on the inside front cover in the first chapter and elsewhere will be found very convenient, and there is also a complete index.

The authors have evidently decided to confine their attention to the advances in the knowledge of the theory and design of concrete structures, and have brought the book well up to date in this regard. Nothing has been omitted from the descriptive chapters and they are quite as satisfactory as in the first edition.

Modern Baths and Bath Houses. By Wm. Paul Gerhard. 327 pp., 130 figures; cloth, $3, net. John Wiley & Sons, New York, N. Y.

The author has prepared a handsome and quite comprehensive book upon a subject which is of growing importance in the public eye, for it is largely devoted to public baths of various sorts. Aside from the plumbing features, the entire field is covered in the text, and this is really quite well taken care of in the specifications for a municipal bath house, which are given in one chapter. There are some repetitions, occasionally even triple repetitions, on account of the insertion of papers and articles written by the author at various times, and quotations from other authors, which are not edited with a view of saving space in the book and the time of the reader, but otherwise the original work of the author and his selections from others have been done very satisfactorily. He evidently speaks from practical experience and much observation of conditions in this and other countries.

The first chapters give some historical notes and general statements regarding the purposes and various forms and media for baths. The fourth chapter describes in detail "The Modern Rain Bath," and nearly every subsequent chapter continues and reiterates again and again the arguments in favor of its adoption under almost every condition. The next succeeding chapters describe baths in private houses and tenements, public bath houses in foreign countries, people's baths, including public and semi-public baths open to the public without charge or with a very small charge, both at home and abroad, factory and workingmen's baths, school baths, baths for military barracks, armories, prisons, jails and police stations, for hospitals, for club houses, gymnasiums, hotels and barber shops. There is also a short chapter on river and sea baths, and there are others on air and sun baths, medical and electric-light baths.

The chapter on water supply and plumbing of bath houses is brief and to the point, rather general in its nature, but showing some valuable appliances and giving the detailed specifications referred to above.

The work closes with a bibliography of English, American, German and French books, reports, pamphlets and articles on all phases of the subject, and an appendix giving extracts from various authors describing methods of bathing in Russia, Scandinavian countries and Japan, and a description of the German baths for dogs.

The book is handsomely illustrated, and will be of much assistance to the rapidly increasing number of municipal officials and public-spirited manufacturers and other citizens who are agitating and actually accomplishing the introduction of methods of keeping clean to those who cannot install bath rooms in their own houses or find them in the habitations they are able to rent.

Development and Electrical Distribution of Power. By Lamar Lyndon. Cloth, 323 pp., $3 net. John Wiley & Sons, New York.

The author disclaims any intention of writing a text-book on his subject, but has made a very convenient compendium of the steps to be taken in investigating the utilization of a water power in the production of electricity and its transmission to a distance. The first 150 pages or so are devoted to the statement of the author's method, with practical and somewhat detailed working out of some of the steps, and the remainder of the book is filled with descriptions of nine prominent hydro-electric power plants, taken from the technical periodicals and condensed to a greater or less extent.

The treatment of the chapter on electrical equipment apparently presumes an intimate knowledge of electrical theory and construction, while that of the hydraulic development is given over to comparatively simple details, seemingly with the assumption that the electrical engineer is not familiar with these principles and needs to be led by the hand through them. It is evidently not possible to produce a complete treatise within the limits of 70 pages, and the author refers to the text-books on hydraulics for more

thorough treatment. He falls readily into the short speech of the practical electrician, which is not always strictly correct, but stands for the correct statement with those who are versed in the "slang" or "lingo" of the profession.

On account of his restriction of his treatment to the one theme, the author has produced a practical book, which will be a great convenience as a guide to the engineer who comes fresh to this sort of problem, as well as for a reminder to the one who is practiced in it.

Domestic Sanitary Engineering and Plumbing, dealing with domestic water supplies, pump and hydraulic ram work, hydraulics, sanitary work, heating by low pressure, hot water, and external plumbing work. By F. W. Raynes, R. P. Cloth, 474 pp., $3 net. Longmans, Green & Co., London and New York.

The plumber and sanitary engineer are one and the same man in England, and this book covers both fields so far as individual houses are concerned. Much detailed instruction is given in plumbing materials, their properties and mode of manufacture, roof work, pipe fixing, bending and joints, solders, fluxes and lead burning, sanitary fittings and accessories, soil and waste pipes. Then the design of drainage systems for houses, the disposal and treatment of sewage from country houses, their water supply, methods of raising water, are discussed, and the last chapters, after one on the elements of hydrostatics and hydraulics, take up the domestic hot water supply, and low pressure hot water heating apparatus.

If the chapters on plumbing are supplemented by some such book as Starbuck's "Modern Plumbing" ($4), giving examples of American practice, this book will be the most complete and detailed upon its subject which is on the market.

The sanitary engineer who has country residences and unsewered parts of cities in his practice will find the chapters on sewerage, sewage disposal and water supply particularly satisfactory, if he will make the one modification made necessary by the more liberal supplies of water provided in this country.

American Playgrounds, their construction, equipment, maintenance and utility. A compilation of serviceable information concerning what has been and what should be done to provide suitable recreation and rational physical training by approved modern methods for the benefit of the people. A practical manual for supervisors, instructors, committees and others desiring knowledge of how and what to do. Edited by Everett B. Mero, with special contributions and extracts from writings of a dozen named experts in the work, and other authorities. Cloth, 270 pp., $1.70 net, postpaid. American Gymnasia Co., Boston, Mass.

The book is all that its title page promises, and more, for it imparts the enthusiasm which is in every line of the writing of both editor and those from whom he quotes. It is the first book of the kind in the English language, and it covers the field so thoroughly that no other book will be needed until the movement, which is now becoming so popular, has developed beyond the limits now reached in any of its manifestations.

The various parts go into detail in their chapters, regarding how and why to provide for general exercise and recreation; organization, construction and equipment of playgrounds; special points for supervisors and instructors; games and exercises for children and grown-ups; the Chicago method in action; miscellaneous information, a number of quotations and extracts, and a list of available books.

The promoter, organizer or supervisor of a playground movement will find the book all but indispensable. It can be obtained of the Dale Association, Back Bay, Boston, Mass.

A Text-Book on Roads and Pavements. By Prof. Frederick P. Spalding. 350 pp., cloth, $2. John Wiley & Sons, New York, N. Y.

Professor Spalding has in this third edition brought down to date a book which was first published in 1894, and he has increased its size more than 50 per cent. in the process. As a text-book for a class in this subject it should be very satisfactory. It is not so complete nor so thorough as the treatises prepared by several other authors, but in general it follows good practice and is an excellent guide in the study of the subject.

The chapters treat of road economics and management, drainage of streets and roads, location of country roads, improvement and maintenance of country roads, broken stone roads, foundations for pavements, brick, bituminous, wood block and stone block pavements, and city streets.

It will be seen that roads have a large share of attention, practically half the book being devoted to them and the other half to street pavements.

The increase in knowledge about road-making and street paving will be shown very well by a brief enumeration of the principal subjects which cause the increase in the size of the book by introducing new material, and which require rewriting of other sections. With reference to roads they are: Size of wheels, width of tire, cost of wagon transportation, economic value of road improvement, sources of revenue, road management, sub-surface drainage, concrete culverts, design of roads, earth work, earth, gravel, oiled, petrolithic, sand-clay, and miscellaneous roads, modern road specifications, road making materials and tests thereof, binders, road maintenance, bituminous macadam. With reference to pavements they are: Trenches in pavements, gravel, broken stone, concrete and bituminous foundations, qualities and tests of paving brick in detail, construction of brick pavements in detail, chemical constitution of bitumens, brief descriptions of the various asphalts, asphaltic cements and surface

mixtures, tests for asphalt cement, binder and surface courses of asphalt pavements, bitulithic pavements, the modern wooden block pavement, specifications and tests for creosoted wood blocks, construction of wood block pavement, specifications for granite blocks and fillers for block pavements, cross-sections of streets and alleys, concrete sidewalks, curbs, gutters and crossings, street railway tracks, selection of pavement, durability of various surfaces, sources of revenue.

While there are chances for difference of opinion upon some of these subjects, it is evident that the author has kept pace with the advancement in paving knowledge and methods.

ORGANIZATIONS AND INDIVIDUALS

Smoke Inspectors—Cement Shows—National Municipal League—International Municipal Congress—Technical Meetings—Civil Service—Bureau of Mines—Technical Schools—Personal Notes

The Smoke Inspectors Convention.

The fifth annual convention of the International Association for the Prevention of Smoke was held in Minneapolis on June 29 to July 1, inclusive. The papers which were read were: "The Harrington Automatic Stoker," by Mr. Joseph Harrington, of Chicago; "Forced Draft and Its Relation to Combustion," by Mr. C. F. Hodges, of Hyde Park, Mass.; "The Taylor Stokers and Steam Boiler Efficiency," by Mr. R. S. Riley, of Providence, R. I.; "Gas Producers as Related to Smoke Prevention," by Prof. R. H. Fernald, in charge of U. S. Geological Survey office at Cleveland, O., and "Furnace Draft in Its Relation to Smoke Prevention," by Mr. Sylvester S. Howell, of Chicago.

The officers elected for next year were: Mr. Paul Bird, of Chicago, president; Mr. Malone, of New York, N. Y., vice president; Mr. Harris, of Toronto, secretary and treasurer.

The place of meeting for 1911 is New York City and for 1912 is Indianapolis, Ind.

The New York and Chicago Cement Shows.

It is announced that the first annual New York cement show will be held in Madison Square Garden, December 14-20, 1910, and the fourth annual Chicago show will be held in the Coliseum, February 17-23, 1911. The show at New York is the first venture in that city, but it is believed that the show there will prove quite as successful, if not more so, than the annual Chicago cement show.

The Cement Products Exhibition Company has already promised that the New York show, as well as the next Chicago show, will have a somewhat different aspect from previous cement shows. It is expected that there will be some change in the general character of the exhibitors. Many of the larger construction companies have become interested in the possibilities of the shows, and as a result will have on display some most unusual and valuable exhibits, with the idea of interesting the business man and the public generally in the advantages of reinforced concrete construction.

The National Municipal League's Annual Meeting.

The next meeting of the National Municipal League will be held in Buffalo, November 14-18, at the invitation of the Buffalo Chamber of Commerce. Among the questions to be considered are: The unearned increment in municipalities; the use of schoolhouses as civic centers; the significance of recent revelations of graft; how can graft be overcome and eliminated; the necessity for uniform accounting and budgets; the importance of a municipal balance sheet; recent franchise settlements; electoral reform; municipal health and sanitation.

The International Municipal Congress and Exposition.

The International Municipal Congress and Exposition is to be held in the Coliseum at Chicago, on September 18 to 30, inclusive, 1911. In connection with the exhibits will be installed comprehensive displays and the practical operation of machinery and appliances used in all branches in every modern municipal undertaking, with particular attention given

to such exhibits as illustrate modern methods of city cleaning, sanitation and public improvements. Among other classes of exhibitors who already have made application for space, will be the manufacturers of material used in building construction, engineering, paving, road making, parks and playgrounds, street lighting, transportation systems, telephones, garbage collection and disposal, street cleaning and sprinkling, fire and police organization and equipment, water works, sanitation and health, hospital, school and library appurtenances, municipal office requirements, and, in fact, everything that enters into the building and upkeep of municipalities everywhere.

Technical Meetings.

The annual meeting of the American Public Health Association will be held at Milwaukee, Wis., September 5, 6, 7, 8 and 9. W. C. Woodward, secretary, Washington, D. C.

The annual meeting of the Association of Edison Illuminating Companies will be held at Thousand Islands, N. Y., September 6, 7 and 8. Walter Neumuller, assistant secretary, 55 Duane street, New York City.

The annual convention of the International Association of Municipal Electricians will be held at Rochester, N. Y., September 6, 7, 8 and 9. Frank P. Foster, secretary, Corning, N. Y.

The annual meeting of the Michigan Gas Association will be held September 6, 7, 8 and 9, on board steamer sailing from Detroit, Mich. Glenn R. Chamberlain, secretary, Grand Rapids, Mich.

The annual convention of the Colorado Electric Light, Power and Railway Association will be held at Colorado Springs September 21, 22 and 23. J. C. Lawler, secretary, P. O. Box 938. Colorado Springs.

The annual convention of the New England Water Works Association will be held at Rochester, N. Y., September 21, 22 and 23. Willard Kent, secretary, Narraganset Pier, R. I.

The annual meeting of the National Irrigation Congress will be held at Pueblo, Colo., September 26, 27, 28, 29 and 30. Arthur Hooker, secretary, Pueblo.

The program for the tenth annual convention of the Texas Mayors' Association held at Tyler, Texas, July 28 and 29, included the following: "Municipal Problems," Capt. Paddock, Ft. Worth; "Commission Form of Government," Mayor Fisher, Galveston; Mayor F. C. Highsmith, Mineral Wells; Mayor G. C. Bird, Greenville; A. B. Loach, Texarkana. "Initiative, Referendum and Recall," Mayor Atchison, Denison; Commissioner Mulkey, Ft. Worth; "Building a City," Mayor H. Baldwin Rice, Houston; "The City Beautiful," George E. Kessler, park expert, Kansas City; "How to Keep Municipal Improvements of Western Texas Cities Apace with Their Rapid Growth," Mayor Malanchette, Stanford; J. R. Delay, Plainview; T. D. Mathews, Haskell; J. N. Haney, Canyon City; "Municipal Improvements in Eastern Texas Towns," Mayor John H. Bonner, Tyler; T. S. Caven, Marshall; Y. L. Charles, Teague; B. F. Sherrell, Jefferson; Mayor Bodenheimer, Longview; "Municipal Sanitation," John B. Hanley, Texas; "Water Meters and Their Economy," Paul Hamilton, New York.

The convention of the International Association of Fire Engineers will be held in Syracuse, N. Y., on August 23, 24, 25 and 26.

The Civic League of St. Louis has issued a booklet advocating the establishment of an outer park system for the city.

The League of American Municipalities will hold a meeting at St. Paul on August 23, 24, 25 and 26. The program will include the following papers of interest to engineers: "Collection and Disposal of City Waste," by Dr. P. M. Hall, of Minneapolis; "The Street Paving Problem," by Hon. Martin Behrman, of New Orleans, Mr. Frank F. Fowler, of Chicago, and Mr. E. R. Schreiter, of Detroit. John MacVicar, secretary, Des Moines, Iowa. A municipal exposition will be held in connection with the meeting.

The annual meeting of the American Society for Testing Materials was held at Atlantic City, N. J., on June 28 to July 2. The reports of the Committee on Standard Methods of Testing and the Committee on Standard Specifications for the Grading of Structural Timber were accepted by the convention; and the report of the Committee on Standard Tests for Road Material was accepted subject to the result of a letter ballot. The Committee on Standard Specifications for Paving Brick presented a progress report in which it was stated that no specifications would be presented until further data were obtained. In addition to the committee reports there were presented some 35 technical papers on matters connected with the composition, manufacture and testing of materials.

The Federal Bureau of Mines.

The act establishing a Bureau of Mines in the Department of the Interior, approved May 16, 1910, became effective July 1. As originally approved, the law contemplated the transfer of the entire technologic branch of the United States Geological Survey, the mine accident investigations, fuel investigations, structural materials investigations, the entire personnel, property and equipment, to the Bureau of Mines, but the sundry civil appropriation act, approved June 25, amended the law to such an extent that the structural materials investigations, including the personnel and equipment for these investigations went to the Bureau

of Standards, Department of Commerce and Labor.

The last of the bulletins of the technologic branch to be published by the Survey will be issued from the Government Printing Office about August 1. This bulletin relates to the explosibility of coal dust, and was prepared by G. S. Rice, with chapters by J. C. Frazer, Axel Larsen, Frank Haas and Carl Scholz.

The first of the Bureau of Mines bulletins, "The Volatile Matter of Coal," by H. C. Porter and F. K. Ovitz, will be published in the next few months. Then will follow "Coal Analyses," by N. W. Lord and J. S. Burrows; "Final Data Regarding Steam Tests," by L. P. Breckenridge; "North Dakota Lignite as a Boiler Fuel," by D. T. Randall and Henry Kreisinger; "Producer Gas Tests in 1905-1907," by R. H. Fernald; "The Coke Industry as Related to the Foundry," by Richard Moldenke; "Coals for Illuminating Gas," by A. H. White and Perry Barker, and "Petroleum for Combustion Under Steam Boilers," by I. C. Allen.

These publications, when issued, can be obtained by addressing the director of the Bureau of Mines, Washington, D. C.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

August 10-11—Aid in the Coast and Geodetic Survey, at $720 and upwards. Deck officer, at $900 and upwards.

August 24-25—Draftsman (marine engines and boilers), at $1,800.

The Technical Schools.

"Tests of Timber Beams," by Arthur N. Talbot, issued as Bulletin No. 41 of the Engineering Experiment Station of the University of Illinois, is a detailed report of the tests of a large number of full-size timber bridge stringers. The test beams included new, seasoned, and creosoted wood of several species. The report also gives the results of shear and bending tests on specimens cut from the large beams. Important conclusions concerning strength and other properties of structural timber are given.

It is a recognized fact that practical work along engineering lines, even in the subordinate positions, gives the young technical student better insight into his school work, and fits him to be of use to his employer upon graduation. In accordance with this idea the University of Pittsburgh has entered into an agreement with various industrial concerns, so as to offer the student summer employment along the lines which he is following in his school work. In this way the student follows a line of employment during the summer which is fitted to his own abilities and which prepares him for further advancement. While in the employ of these industrial concerns he is classed as an employee and receives an apprentice's wages in addition to university credits given upon the submission of a written report of the summer's work. The plan will be put into operation October 1, 1910.

Delaware College, of Newark, Del., has issued its catalogue as one of its regular quarterly bulletins. Courses in science, art, agriculture and engineering are offered by this college.

Personal Notes.

R. S. Alexander has been elected city engineer at Clarksville, Tenn.

Hon. T. C. Thornton, mayor of Warrenton, Va., died at his home, July 11, aged 70 years.

Charles G. Armstrong has been appointed consulting engineer in the department of bridges of New York City.

August Forsberg, who was city engineer of Lynchburg, Va., died July 15, at his home in that city, aged 79 years.

Mr. Frederick A. Mallette, former president of the board of public works of Geneva, N. Y., died at his home in New York City, July 16.

Hugh Crozer, of Knoxville, Tenn., has resigned as chief engineer of pike road work in Coche county, and is succeeded by Herbert Holt, of Newport, Tenn.

William Wood has resigned as chairman of the Cooke county pike commissioners, at Newport, Tenn., and John Weaver has been elected to succeed him.

W. E. Conner and A. A. Hanscom have been appointed junior engineers in the United States Reclamation Service, and have been assigned to the Milk River project.

H. B. Pearson, Jr., has been appointed city engineer at El Centro, Cal. The city engineer is made ex-officio superintendent of water and sewers and superintendent of streets.

James B. Faulks, Jr., Jun. Am. Soc. M. E., associate professor in the College of Engineering of Syracuse University, died at Syracuse, N. Y., July 15, of typhoid fever, aged 38 years.

Mr. John Finan has accepted a position with the Kaps-Brehm Company, engineers and contractors, of Cincinnati. He is at present in charge of a contract for the Gest Brewing Company, of Nashville, Tenn.

Mr. Walter B. Snow, publicity engineer, Boston, Mass., has added to his staff Mr. H. Ross Callaway, a graduate of the Massachusetts Institute of Technology, and late assistant to the mechanical engineer of the New York Edison Company.

Robert A. Howard, for the past twenty-four years surveyor of Wayne county, died Thursday, July 21, at his home in Richmond, Ind. Mr. Howard was 81 years old. Since 1886 Mr. Howard had been surveyor, without opposition at any election.

The department of public works of Paterson, N. J., has issued a pamphlet containing the accepted form of proposal, agreement and specifications for all paving work. Mr. H. J. Harder is the city engineer of Paterson, and to him is due the credit for the work.

On account of the anxiety caused by the prevalence of typhoid fever in Milwaukee this summer, the city council has requested Messrs. Harrison P. Eddy, of Boston; John W. Alvord, of Chicago, and Geo. C. Whipple, of New York, to hasten their report on sewage disposal. The sewage of Milwaukee is discharged into

Lake Michigan, and the water supply is taken from the lake at a distance of 1½ miles from the shore and 60 feet below the surface.

Miss Helen Hamilton, of Detroit, who is a student in engineering at the University of Michigan, believes an energetic young woman ought to be as successful in bossing a gang of men as in bossing a room full of school children. Sewer building will be her specialty.

Calvin H. Vanauken, 74 years old, a widely known civil engineer, was killed July 19, in Auburn, Ind., when the carriage in which he was driving across the Lake Shore Railway tracks, was struck by a passenger train. Mr. Vanauken was once surveyor of Dekalb county and was a pioneer.

Silas G. Comfort, Assoc. M. Am. Soc. C. E., vice president and professor of engineering of Pennsylvania Military College, Chester, Pa., was found dead, July 13, in the shallow waters of a small creek near Chester. His death was, in the estimation of the coroner, accidental. Mr. Comfort was appointed consulting engineer for the city of Chester in regard to new sewers, paving and water supply, about one week before his death.

MACHINERY AND TRADE

The Stedman Estimeter.

The Stedman Estimeter, shown in the accompanying photograph, is a mechanical device for measuring and adding lines. The method of operation is simple, the results obtained are accurate, and either straight or curved lines may be measured. The instrument is held in a perpendicular position, with the arrow pointing to the place where the measurement starts. By traversing over the lines to be added, the

total number of feet will be indicated on the dials at a scale of ¼ inch to the foot. Measurements of other scales may be obtained by proportion. A slight pressure on the push button to the right of the dials restores all the dials to the starting point.

The instrument may be obtained from the Stedman-Johnson Manufacturing Company, of Cleveland, O.

The Harrison Integral Method of Waterproofing Concrete.

The "Harrison Integral" method is the name applied to the process of waterproofing concrete by adding "Harrison Compound" to the cement and aggregate in the mixer. The "Harrison Compound" is a water repellant, impalpable powder, which, when added to concrete, causes the mass to become so dense that no water can be forced through at any normal hydrostatic pressure. As the name implies, the compound becomes an integral part of the mass, and its properties last as long as the concrete of which it is a part. The nature of the compound causes it to be an aid rather than a detriment to the strength and cementing quality of the concrete, and it does not in the slightest degree retard the final setting.

The method of using the compound is simple and involves little extra trouble. The compound in the proportion of eight pounds for every barrel of Portland cement is placed in the mixer with the cement and aggregate and the mass is mixed dry, one or two turns of the mixer being sufficient to insure a thorough incorporation of the compound. In the case of hand mixing the compound is mixed dry with the cement.

The compound is manufactured by the Harrison Water-proof Materials Company, of New York City.

The Polygon Concrete Mixer.

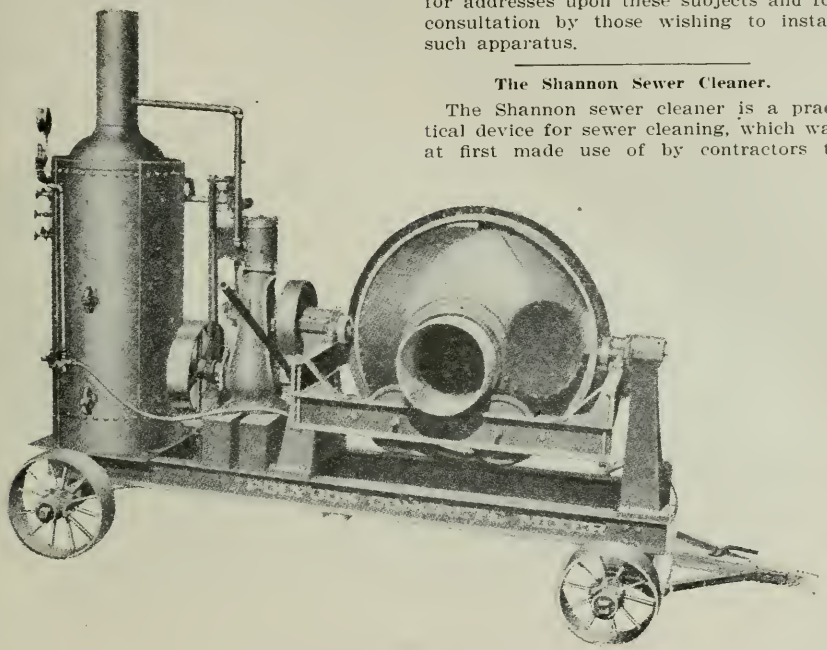
The fundamental requirement, for strength in concrete, is that each particle of sand and rock shall be thoroughly coated with cement. All engineers of today are agreed that concrete cannot be as thoroughly mixed by hand as by the more approved form of concrete mixers; and these mixers vary in the results they obtain according to the principles upon which they are designed.

In the polygon concrete mixer there is an application of the best principles developed up to the present time. The material, in passing through the mixer, is thrown endwise and sidewise alternately, toward and past the center. It allows no settling of particles of materials and it brings about a uniform distribution of moisture, which prevents spots and uneven appearances, sometimes seen in machine-mixed concrete. The construction of the drum (see accompanying photograph) does not permit of corners

nor crevices becoming filled with material which afterwards hardens. In other words, the machine is easily cleaned.

By means of the blades in the interior of the drum, the particles are thoroughly intermingled as to size, thus overcoming an objection present in some other mixers—that of the gravitation of the cement and finer particles to the bottom of the mass. These blades are fastened to the drum with sufficient projection to avoid the secreting of concrete.

Not the least among the advantages of the drum is the rapidity of its action. The red oxide of iron test shows that in ten revolutions of the drum, or less than thirty seconds, every particle of the



THE POLYGON CONCRETE MIXER.

charge is coated, and the batch is of a uniform tint.

The machine is a batch mixer, and the discharge of material may be regulated even while the machine is running at full speed. The outlet is so arranged that it is unnecessary either to build a runway or to excavate in order to facilitate dumping into a wheelbarrow. The tilting is controlled by one man, who also controls the loading of the charge.

The polygon mixer is made by the Waterloo Cement Machinery Corporation, Waterloo, Ia. Catalogues and full information will be sent upon request.

Garbage Reduction.

Col. Wm. F. Morse, consulting sanitary engineer, 111 Broadway, New York, has been longest in the work of garbage destruction of any engineer in the country. He is now engaged in the designing of special forms of crematory furnaces for the waste of railway stations, public institutions, hospitals, hotels and private business establishments, special attention being given to the equipment for disinfection and for the disposal of refuse from tuberculosis hospitals and sanitariums and from medical schools and colleges. He has installed many such plants, as well as many others for municipalities. He has made a summary of the present condition of the subject in his book on "The Collection and Disposal of Municipal Waste." His services can be secured for addresses upon these subjects and for consultation by those wishing to install such apparatus.

The Shannon Sewer Cleaner.

The Shannon sewer cleaner is a practical device for sewer cleaning, which was at first made use of by contractors to facilitate their work, but, through its merit, has become so popular as to warrant its being placed on the market. The cleaner consists of a trough with rounded, shovel-shaped ends and a cover and flap valve. To operate it a rope is passed through the sewer from one manhole to the next. This rope is passed through a pulley fixed at the bottom of the second manhole by means of a brace temporarily set in the sewer. By means of this rope the cleaner is drawn through the sewer from one manhole to the next, by a windlass set above the second manhole. When the cleaner reaches the second manhole, the line holding the pulley to the brace in the sewer is slackened, allowing the cleaner and pulley both to be drawn to the surface. The cover is then removed

and the contents are dumped. The cleaner is of the double-end construction, so that it may be drawn back again to the first manhole without changing any ropes or pulleys. There are lugs on the bottom of the cleaner, which serve to keep it upright and allow it to pass over obstructions.

The apparatus requires only three men to operate, and at no time does a man enter the sewer during the operation of the cleaner. Practical tests of the machine show it to be capable of cleaning in one day 570 feet of 15-inch pipe at a depth of 23 feet below the street surface.

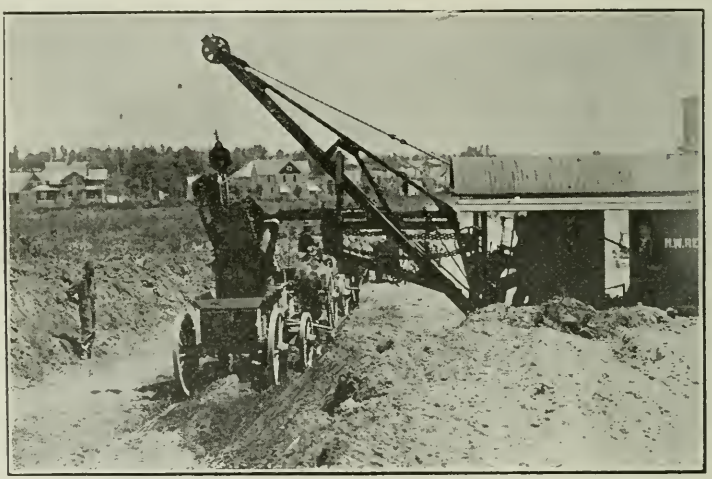
The apparatus entire, consisting of two windlasses, blocks and pulleys, 600 feet of wire rope, and cleaners for 8 to 10-inch pipe, 12 to 15-inch pipe, 18 to 24-inch pipe, and sewers over 2 feet in diameter, may be either leased or purchased from the Hayden Machinery and Supply Company, of 30 Church street, New York.

able nozzles, so that practically any desired angle of incidence of the water on the pavement can be secured.

Two great points are the constant pressure which is maintained by the pump and the ability to regulate this pressure at any point between 5 and 32 pounds, and keep it so until the tank is completely empty. Two of the principal objections to pressure flushing are thus eliminated, fluctuation in pressure and inability to regulate the pressure exactly according to the demands of the service. It is thus possible to clean a difficult street not in perfect repair with a minimum of damage from water pressure, and more safely than by any other effective method of cleaning. The company will send full information on request.

Imperial Waterproofing Keeps Out Water.

The success of Imperial waterproofing in keeping water out of underground



LOADINC STUDEBAKER DUMP WAGON WITH STEAM SHOVEL.

Loading a Dump Wagon with Steam Shovel.

One of the severest strains to which a dump wagon can be put is loading with a steam shovel. The illustration shows a loaded shovel in the act of discharging a full square yard of dirt into a Studebaker dump wagon from a height of fully 8 feet. The excavating is being done in Navarre Place, South Bend, Ind., by H. W. Reed & Sons.

A High-Pressure Street Flusher.

A new high-pressure street flusher has been put on the market by the Studebaker Bros. Manufacturing Co., South Bend, Ind., which has some points of decided advantage. It consists of a 750-gallon water tank on a truck platform gear, a gasoline engine underneath, driving a centrifugal pump and a distributing pipe between the wheels, equipped with adjust-

structures under difficult circumstances is shown by the following letter, which was signed by the five members of the board of supervisors of Los Angeles county, California:

It gives us pleasure to make a statement concerning the efficiency of Imperial waterproofing.

When you offered to stop the flow of water coming into the court house elevator tunnel running from New High st. to the court house elevator, we looked upon your proposition as a huge joke, as the water was flowing like springs in a great many places all over the roof of the tunnel, but to-day there is not a particle of water flowing into the tunnel, or any indications of water whatever; besides, you have improved the appearance of our tunnel 100 per cent., and the small amount of expenditure we have made in applying the waterproofing is very much appreciated by the public.

Imperial waterproofing is certainly a

wonder, and if it is permanent, as you claim, it is certainly one of the most valuable commodities on the market.

Imperial waterproofing is put on the market by the A. F. George Co., 811 S. Spring st., Los Angeles, Cal., who will supply any desired information about it.

The Clark Meter Box.

The Clark meter box, manufactured by H. W. Clark & Co., of Mattoon, Ill., is designed to do away with the old practice of having the water meter situated within the house. It consists of a box of vitrified earthenware or concrete, set in the ground to such a depth as to be beneath the frost line. The meter, test cocks, fish traps and other accessories that should be open for inspection are contained within the box. A cast iron cover, with a removable lid, completes the box and furnishes a means of ready access to the interior. The meter is placed near the top of the box, so as to be easily inspected and so as to provide that warm air completely surround the instruments and prevents freezing.

The accompanying photograph shows the exhibit of the H. W. Clark Company at the convention of the American Water Works Association in New Orleans, where it was an object of much interest and drew the attention of many visitors.

The Troy Dump Box.

One of the standard dump boxes for use on ordinary teaming or farm wagon gears is the Troy, made by the Troy Wagon Works Co., Troy, Ohio. The box is of hard maple and the bottom is made of four leaves or doors of No. 10 gauge steel, bent at right angles along the outer edge and two are hung from the sides of the box, and the other two from a shield extending lengthwise through the center of the box, which protects the reach in the gear.

The doors are closed to place by chains at the ends which are wrapped round spiral grooves on the ends of a shaft attached to the outside of the box. This shaft is turned by a lever with ratchet at the driver's right hand.

The outer doors overlap the inner in closing, so as to make the bottom sand-tight, and the doors are thoroughly braced, ends and sides, with angle irons, so as to keep their shape under hard usage. These boxes have 1½ cubic yards capacity, or 2 yards with top box added.

The company also make the Troy bottom-dump wagons, gear and body in one, which are the most economical for continuous and heavy work. These wagons are made with capacity of 1½ to 5 cubic yards.

Catalogs will be sent on request.

Bitulithic Recommended for York, Pa.

A formal report giving the members the benefit of their observations, was presented at a recent meeting of the city council of York, Pa., by a party of councilmen who had visited Atlantic City, Wilmington and Baltimore to inspect paving. The councilmen reported that they had viewed many different kinds of paving and recommended the bitulithic. In the party were Councilmen Rose, Craumen, Bahne, Hake, Myers, Bentzel, Lish and Brenner.

The report follows:

The undersigned members of City Councils visited Atlantic City, Wilmington, Del., and Baltimore, Md., and made a careful and thorough examination of the street paving in those cities. We were given an opportunity to inspect all the different forms of pavement, bitulithic, brick, asphalt and wood blocks.

At Atlantic City, Tennessee avenue for one square is paved with wood block, and looked fine. We were, however, told by teamsters whom we questioned that it was very slippery in wet weather and that horses frequently fell on it. A gentleman whom we asked told us that this pavement cost $3.29 per square yard. We noticed some brick paving around the railroad station and in the alleys, some of which was good and some showed the result of wear and tear and was very rough and uneven.

Atlantic avenue, which is the main business street was paved with bitulithic,

a hundred feet wide and five miles long, and was n perfect condton. In addton This pavement is now in its fourth year and was in perfect condition. In addition to Atlantic avenue, there are twelve other streets paved with bitulithic. We rode or walked over these streets and we did not find a single hole or worn place. We were informed that the city has laid over 400,000 yards of this form of pavement, 50,000 yards of which were laid last fall, and we understand that the city expects to lay more of it this season. We talked with a number of city officials and other citizens, and all seem enthusiastic in their praise of the bitulithic pavement, preferrng it to any other form of paving.

We met the chief of the fire department, who made a run for us from two of the fire stations and we noticed that the horses, although smoothly shod, did not slip at all while running at top speed on the bitulithic pavement. The chief told us that the horses seemed to know the pavements, that they run with perfect freedom on the bitulithic, but would immediately slow down when they struck the brick or asphalt. In general, we noticed that the streets of Atlantic City were kept in splendid condition. It is the cleanest city we have ever seen.

From Atlantic City we went to Wilmington, Del., and drove over about three miles of streets. We found brick, asphalt and bitulithic. We saw on Market street, the main business street, one square of asphalt and one square of bitulithic immediately adjoining, which we were told the city laid five years ago as a comparative test. The bitulithic was, as far as we could see, in as good condition as were the bitulithic streets that were laid last year, but the asphalt was a mess, full of holes and worn places, though we were told that it had been repaired several times. The brick streets were in wretched condition, some of them almost impassable. The bitulithic paved streets were apparently as good as at Atlantic City, though a year older. There are about 300,000 yards of bitulithic pavement in Wilmington, but we did not see any asphalt except the one square above referred to.

From Wilmington we went to Baltimore, Md., and spent four hours driving and inspecting the streets. The first bitulithic in Baltimore was laid in the spring of 1906, Twenty-fourth street. It was in perfect condition. There are 75,000 yards of this pavement spread over thirty-seven streets. The amount laid in each year as given us by the superintendent who did the work is as follows: 1906, 34,546; 1907, 55,422; 1908, 97,322; 1909, 31,549 yards. If it were possible for any pavement to be better than we found in Atlantic City, it is here in Baltimore.

In conclusion this committee has to say that in our judgment the bitulithic pavement is far ahead of any form of pavement we have ever seen. It is smooth, without being slippery. There is a slight give to it, which makes it very easy on horses. It is clean, sanitary, quiet and best of all, it is durable. We earnestly recommend its construction to councils and citizens of York.

The Regulation of the Amount of Sulphur in Gas.

Only in four States of the Union and in the District of Columbia are there State regulations in regard to the amount of sulphur permissible in gas. In all of these, with the exception of Wisconsin, the limit is substantially 20 grains. In the latter State it has been increased to 30 grains. Massachusetts has had a struggle with the proposition to make a similar increase in the limit. At a legislative hearing, Mr. Arthur D. Little, chemical expert and engineer, of Boston, presented in brief the results of some most exhaustive experiments conducted to determine the influence of surphur in gas on the air in rooms. He showed that the present local restrictions are the outgrowth of ignorant legislation in England, where under the Gas Metropolis Act in 1860, Parliament limited the sulphur content of the gas supply in the city of London to 20 grains per 100 cubic feet.

The Massachusetts bill provided that "the Board of Gas and Electric Light Commissioners shall from time to time ascertain and prescribe what degree of purity may reasonably be required." At the hearing the Board recommended that the amount of sulphur allowed in illuminating gas be specifically increased from 20 to 30 grains. This recommendation was adopted at the hearing by the counsel for the Massachusetts Association of Gas Companies, who declared that the extra sulphur would help the companies operate cheaper, would prevent their violating the law against their will, and would injure no one. But the Board stated their decision to be that the question of purity is a question of such breadth of public fixed by the legislature before and has been satisfactory, and therefore see no reason why this policy should not be continued.

The evidence presented by Mr. Little and based upon his experiments showed that he had been unable to discover any possibility of injurious effects resulting from raising the limit to 30 grains. He presented a summary of the results of the careful investigation made in Wisconsin which led to a corresponding increase. It was shown that a lower sulphur restriction in gas would greatly limit the gas companies in the coal that they could use, and make it necessary for them to pay a much higher price for coals of lower sulphur content. The Wisconsin Commission was quoted as authority for the statement that they could not find that it had ever been well demonstrated that the difference of a few grains in the sulphur content of gas had any appreciable effect upon the air of rooms in which gas was burned, or effects that were otherwise harmful to health or property. It seemed to them that most of the gas restrictions were not founded upon inaccurate knowledge, but rather upon a blind following of the precedent set in other places. Mr. Little's experiments, which cover a period of some months, were conducted in a house set aside for the purpose, and include a study of the possible effect of gas under varied conditions. It was shown fundamentally that the sulphur gases formed in the combustion of illuminating gas are

removed from the air in three ways: By changing air in the ordinary course of ventilation; by condensation along with water vapors on the cold walls and closets, and through absorption by the alkaline constituents of the walls and ceilings. Mr. Little's experiments show that only within narrow limits does an increase in the sulphur content of the gas or of the rate at which the gas is burned cause a relative increase in the sulphur content of the room. In other words, that the disappearance of the sulphur gases increases with the concentration at which they exist in the air. Analysis of the plaster of the experimental room showed that there had been a natural increase in the amount of sulphur which it contained, but calculations showed that the plaster of a ceiling would serve to absorb sulphur gases from 20-grain gas burning 25 feet per day during the probable existence of a house. When the plaster was covered with paper the absorption was but moderately reduced.

The outside air was found to always contain considerable amounts of sulphur; at times from one-third to one-quarter as much as in the air of the room in which gas was being burned. It was impossible within the ordinary range of conditions to discover any odor to the sulphur in the gas. Samples of dyed goods were exposed in the room without discovery of any perceptible fading, and bright metals were in some cases tarnished more by the outside air than that within the room. The analysis of sulphur matches showed that they would liberate as much sulphur into the room as ordinarily would be liberated by 20-grain gas burning for 22 minutes. In connection with the hearing above referred to, Chairman Forrest E. Barker spoke as follows:

"In regard to the contention of the companies that they should not be fined if the excess of sulphur is due to an unavoidable cause or accident, I assume that, if the committee inserts such a clause in the bill it will do so only after it has become fully satisfied as to what such a clause means. I doubt if we know what such a clause would mean. I say what I do with respect to the construing of this clause after what has been said in favor of removing the restrictions on gas. I think that we have the impression that the companies think occasionally that sulphur will suddenly appear in gas from unavoidable cause, coming as a complete surprise to the company. If this is true, I wonder if it is fair to say that such a provision in the law might nullify any restrictions which were made.

"Now, in respect to the question of removing all restriction on the amount of sulphur which gas may contain, I want to explain the reference made by the Board to the removal of an obstruction to the reduction in the price of gas. The cost of purification per cubic foot is too small to affect greatly the selling price of gas, but any reduction in the cost of manufacture under proper regulation will eventually work to the advantage of the public either in making the price cheaper or in giving better service.

"I ought to state what you may expect if all restriction is removed. It has been said that about forty grains of sulphur in the gas would be all that would be found. That is not the opinion of the Board. We should expect to find the same amount here as is found in London. In some extreme cases ninety grains have been found. That is an extraordinary amount, but there have been a number of times when tests have shown that there were seventy grains present. It is said that the coal used in London contains more sulphur than that used here. If all restrictions are removed we should expect that the companies here would use coal with a great deal of sulphur in it."

Mr. Barker also stated that he did not believe that anyone knew whether a large amount of sulphur in gas was injurious. In investigating the matter the Board had had the assistance from the Harvard Medical School and the Institute of Technology, and the recommendations of the Board that the limit be placed at thirty grains was the result of the Board's inquiry. Until the presence of sulphur in gas is shown to be harmless, the Board will not recommend the removal of all restrictions.

Trade Publications.

Mr. G. R. G. Conway, chief engineer, has compiled a handsome booklet, describing the distributing reservoirs of the water works of Monterrey, Neuvo Leon, Mexico, and Obispado, in Mexico, on which the Pioneer water-proofing compound of the American Asphaltum and Rubber Company, of Chicago, was used.

The Barrett Manufacturing Company has issued a reprint of an article in the *New England Automobile Journal* describing the application of tarvia to the practical construction and preservation of highways.

"Yellow Pine Creosoted Blocks for Floor Coverings and Between Car Tracks" is the title of a pamphlet issued by the Yellow Pine Manufacturers' Association of St. Louis. They have also issued a booklet on the use of yellow pine creosoted blocks for streets, bridges and crossings.

The Mico reciprocating meter for counting piston travel is fully described in a catalogue issued by the Mechanical Instrument Company, of New York.

The Monthly Bulletin of the Universal Portland Cement Company has photographs and a description of the new machinery exhibition warehouse of the Pfannmueller Engineering Company, of Chicago.

The Pioneer Asphalt Company has issued an illustrated pamphlet on "Good Roads."

"Graphite" is the title of an address de-

livered before the Automobile Club of America, and which is reprinted and issued by the Co-operative Press of New York.

"Modern Incineration," issued by the Decarie Incinerator Company, describes the various plants installed by the company throughout the country. A number of half-tones illustrate the operation of the incinerator and the plants now in use.

The Stone & Webster Engineering Corporation, of Boston, have issued a booklet of work done and work doing for the second quarter of 1910.

The "Ready Drafting Instrument," a pocket combination compass, protractor, rule, scale, square and curve, is described in a leaflet from the Ready Manufacturing Company, of Rochester, N. Y.

"Standard Road Oil" is described by a booklet of that name issued by the Standard Oil Company.

Westrumite cold-laid asphalt pavement is described in a pamphlet issued by the Central Westrumite Company, of Chicago.

The *Edison Aggregate* for June contains a number of half-tones of bridges and dams built of Edison Portland cement.

The Portland sectional conduit is an underground pipe covering, designed to protect pipes from electrolysis and to furnish a perfect heat insulation. It is manufactured by the Portland Stoneware Company. A booklet issued by the company gives complete descriptions of the conduit and the method of handling it.

The Trussed Concrete Steel Company, identified with the Kahn system of reinforcement, has issued a catalogue of rib metal. The catalogue is illustrated by photographs and contains a full description of the use of rib metal. The main office is in Detroit, Mich.

Mr. H. E. Anschutz, C. E., of Montgomery, Ala., has published a map showing the location of all cotton mills in Alabama and Georgia. The map also shows the location of all water power in use or available, and the consumption of cotton per year by each mill.

The Smith patent rail clamp and division plates are devices to replace the old stake method of holding the rails for concrete sidewalk building. A booklet by S. C. Smith & Son, of Waverly, N. Y., describes the devices.

Circulars No. 251, 260, 261, 263 and 264, of the American Asphaltum and Rubber Company, of Chicago, are descriptive of the use of "Pioneer" asphalt in reservoir water-proofing. A booklet called "Pipe Coating Supremacy," by the same company, tells of the use of "Pioneer" mineral rubber pipe coating.

Circular No. 92 of the Office of Roads of the U. S. Department of Agriculture has an account of the progress made along the lines of experiments in dust prevention and road preservation. The experiments were carried on at Washington, D. C., Youngstown, O., and Ithaca, N. Y.

Trade Notes.

ASPHALT.

New York City.—The Eastern Asphalt Paving Co., general contractors, Manhattan, has been incorporated by Samuel J. Garger, Edward M. McInness and Sinclair C. Nussbaum, of New York City.

Spokane, Wash.—J. F. Hill has secured a lease on a site and is making preparations to establish a large paving plant.

Buffalo, N. Y.—The commissioner of public works has been directed to prepare plans and specifications and ask for bids for a municipal asphalt repair plant. Mayor Fuhrmann.

BRICK.

Oakland, Cal.—The Oakland Paving Brick Co., recently organized by E. A. Heron, H. W. Taylor, E. L. Dow, and others, has been begun preliminary work on the installation of its proposed plant at Decatur, Cal.

Hartford, Conn.— The Hartford Vitrified Brick Co. has recently taken over the plant of the Cambria Brick Co., at Bel Air, Md., and is making extensive improvements.

CEMENT.

"Atlas White" is the name of the new white Portland cement now marketed by the Atlas Portland Cement Company, New York. The company has sent out notices to the retail trade that it is ready to make shipments of this product, and guarantee it to be fully up to the high quality of the Atlas brands.

Du Bois, Pa.—Special.—The Du Bois Art Stone Works has a plant in this city, in which any and all kinds of cement products can be manufactured. Owing to the death of the owner and manager, the company has decided to lease it out for a term of years, and would like to communicate with prospective lesseses. Address C. S. Blomen, 515 Locust st.

Nazareth, Pa.—The Dexter Portland Cement Co. has obtained an option on a tract of white clay land near Saylesbury, and will manufacture White Portland cement.

Fairview, Okla.—The Fairview Cement Co. has been incorporated by M. E. and Henry Frame, John J. Nelson, Chas. H. Albert and J. W. Colvin, all of Alva, Okla., and John L. Perkins, of Carmen.

Sioux Falls, S. D.—The Dakota Portland Cement Co., whose headquarters are here, has let a contract for the construction of a plant near Chamberlain, S. D., to the Freeborn Engineering & Construction Co., of Kansas City, Mo.

PURCHASE OF MACHINERY.

Little Rock, Ark.—An ordinance has been passed authorizing the board of public affairs to purchase teams, wagons, and scrapers for the street department. Mayor Duley.

Topeka, Kas.—W. G. Tandy, cy. comr. of streets and public improvements, advocates a number of compressed air street sprinklers for this city.

Morrill, Neb.—Special.—H. A. Mark advises us that this city is in the market for first-class high grade transit with solar attachment. Also, for a plain stripped second-hand instrument in fair condition.

Oakland, Cal.—This city is in the market for a gyratory rock crusher.

MISCELLANEOUS.

New York City.—The C. W. Hunt Co., builders of coal handling, conveying and hoisting machinery, have opened offices

at the State Bank Bldg., Richmond, Va., and also at 607 Rhodes Bldg., Atlanta, Ga., with W. F. Lee in supervision.

New York City.—C. T. Anderson has been appointed manager of the Chicago office, 1616 Fisher Bldg., of the C. W. Hunt Co., builders of coal handling, conveying and hoisting machinery.

Branchland, W. Va.—The Branchland Bridge Co. has been incorporated to build and maintain toll bridges by L. R. Via, A. M. Parsons, L. W. Leete and Rufus Switzer, of Huntington, W. Va., and W. E. Beardsley, of Clarksburg, W. Va.

Considerable trouble was experienced by the street railway company of New Britain, Conn., when they endeavored to break holes in the Church street bitulithic pavement, for the purpose of welding their rail joints. The wearing surface of the pavement was so tough that it was only by means of hammers and wedges that the required openings could be made.

Patents Concerning Construction Molds and Forms.

878,639. Concrete Vault. Boyden Kinsey, Wyoming, O.

878,929. Stock Water Tank (cement). Edward Bergen, Glenbeulah, Wis.

881,678. Concrete Ash Pit. Jas. W. Graham, St. Louis, and Chas. A. Jones, Midland, Mo.

883,859. Framing Support for Concrete Construction. Thos. Corris, Cleveland, O.

884,733, 884,734. Molds for Concrete Walls. John Horsfield, Chicago, Ill.

874,167. Machine for Molding Units of Clay or Other Refractory Material to be Used in the Manufacture of Concrete. Wm. D. Crow, East Orange, N. J.

886,481. Cement Water Tank. John J. Daniel, Cambria, Wis.

890,466. Mold for Tapering Chimney Construction. Carl Stieler, Chicago, Ill.

891,883. Core for Concrete Structures. Joseph Vaughan, Ashland, Va.

892,543. Apparatus for Use in Construction of Concrete Buildings. Nicholas C. Newerf, Buffalo, N. Y.

893,471. Building Construction (molds for concrete). Chas. W. Fellgren, Chicago, Ill.

894,177. Mold for Cement Walls. Jesse W. Alexander, Birmingham, Ala.

896,223. Cement Burial Vault. Wm. H. Marshall, New Paris, O.

897,353. Wall for Buildings. John S. Culley, Louisville, Ky.

900,261. Machine for Forming Artificial Stone Walls. Jacob Brewer, Hazleton, Pa.

901,017. Concrete Building Wall Michael G. Mandt, Stoughton, Wis.

901,523. Mold for Making Burial Vaults. Thos. M. Cass, Ft. Worth, Tex.

902,050, 902,051. Safe and Fireproof Attachment for Vault. Thos. M. Brintnall, Oakland, and Nelson R. Doolittle, Berkeley, Cal.

902,204. Concrete Construction (building). Robert T. Brown, Boston, Mass.

902,311. Concrete Construction (building). Frederick Melber, Ross tp., Allegheny co., Pa.

903,996. Form for Concrete Construction. Chas. M. Markham, Chicago, Ill.

904,433. Concrete Form Holder and Adjuster. John G. Hosmer, Grand Junction, O.

905,416. Cement Burial Vault. Chas. A. Gibson, Indianapolis, Ind.

907,438. Form for Concrete Construction. Wm. L. Axium, Downers Grove, Ill.

907,496. Clamp for Mold Forms for Concrete Columns or Pillars. Wm. H. Healy, San Francisco, Cal.

907,878. Knockdown Form for the Construction of Concrete Bins. John H. Reeves, Orange, Cal.

908,305. Tomb or Burial Vault. Thos. J. Moore, New York, N. Y.

908,326. Apparatus for Building Concrete and Other Like Structures. Walter C. Polk, Ft. Branch, Ind.

910,064. Mold for Forming Burial Vaults. Alonzo O. Hunsaker, Kansas City, Mo.

910,515. Mold for Concrete Building Construction. Edgar J. Drayer, Dayton, O.

910,695. Mold (for concrete walls). Harry Lammon and John Mauska, Lebanon, S. D.

910,883. Mold for Concrete Walls. Wm. E. Turkington, Cherokee, Kan.

912,070. Framework for the Construction of Concrete Buildings. Wm. W. Carpenter, Tampa, Fla.

912,414. Burial Vault. Wm. C. Remmiller and Frank L. Campbell, Atlanta, Ill.

912,997. Burial Vault. Peter F. Dehr, Hinsdale, Ill.

913,090. Mold for Concrete Walls. Leon Barg, New York, N. Y.

913,441. Mold for Concrete Wall Construction. Gotthart Taubert, Pittsfield, Ill.

913,538. Apparatus for Use in Building Structures of Concrete or Other Plastic Material. David Morgan, Launceston, Tasmania, Australia.

914,417. Mold for Forming Burial Vaults. Alonzo O. Hunsaker, Kansas City, Mo.

914,590. Concrete Frame for Door and Window Openings. John H. and Daniel H. Maychel, Salt Lake City, Utah.

918,393. Burial Vault. Albert F. Farr, Franklin, Pa.

917,943. Burial Vault. Chas. K. Haw, Kansas City, Kan.

918,568. Band Tightener for Concrete Forms. Chas. M. Markham, Chicago, Ill.

919,687. Apparatus to be Employed in Building Walls of Concrete. Richard Bowen, Cheltenham, Eng.

921,820. Method of Constructing Buildings and Apparatus Therefor. Alexander Foster, Pasadena, and Edward W. Foster, Los Angeles, Cal.

925,080. Form for Concrete Construction. Jas. Can, Chicago, Ill.

925,204. Concrete Construction and Method of Producing the Same. G. A. M. Liljencrantz, Chicago, Ill.

925,912. Machine for Making Concrete Walls. Alexander J. Innes, Sutherland, Iowa.

926,269. One-Side Mold for Concrete Walls. John H. Magdiel, Salt Lake City, Utah.

926,674. Airtight (cement) Cistern. Bert L. Mills, Hastings, Neb.

927,806. Collapsible Cistern Mold. Dora Laughlin, Dayton, O.

928,392. Bond for Concrete Construction Forms. Chas. M. Markham, Chicago, Ill.

928,638. Mold for Concrete Burial Vaults. Milon J. Demorest, Belding, Mich.

929,470. Concrete Mold. Roy N. Neil, Cozod, Neb.

929,825. Cement Cistern Mold. Newman Bronhard, Toledo, O.

929,938. Mold (for concrete walls). John R. Haldeman, Springfield, Mo.

929,969. Permanent Concrete Form. Michael D. Murray, West Homestead, Pa.

930,102. Mold for Reinforced Concrete Walls. Geo. W. Stevens, Lynn, Mass.

932,092. Ornamental Molded Concrete Article. Geo. H. Bartlett, Boston, Mass.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Oconomowoc, Wis.—Council granted a petition for a sidewalk in West ave.

Jackson, Minn.—The construction of cement sidewalks is contemplated.

Creston, Ia.—A resolution has been introduced for paving Walnut st.

Joliet, Ill.—Brick paving is contemplated for Joliet st. J. R. Crown, mayor.

Caldwell, Idaho.—This city voted to issue $50,000 for paving purposes.

McKenzie, Tenn.—Surveys have been made for graveling the streets.

Brandon, Miss.—The construction of granolithic walks is contemplated.

Marinette, Wis.—A concrete pavement will be constructed here as an experiment.

Marshall, Minn.—The construction of sidewalks in Main st. is contemplated.

Baker City, Ore.—Resolutions have been passed for paving Bridge, Auburn and 2nd sts.

Roseburg, Ore.—The construction of 7 additional blocks of streets is contemplated.

Spring Valley, Minn.—The construction of sidewalks in various streets is contemplated.

East Peoria, Ill.—An ordinance has been passed by the village board for paving E. Wash st.

Elkhart, Ind.—Paving is contemplated for N. Main and Simon sts. A. M. Smith, cy. engr.

Walla Walla, Wash.—City council will ask for bids soon for paving 20 blocks of streets.

Lake Charles, La.—This city voted, July 14, to issue bonds for additional street paving.

Sault Ste. Marie, Mich.—Council has authorized the construction of a cement walk in Askum st.

Seattle, Wash.—Paving is contemplated for Beacon Hill by the Jefferson Park Impvt. Club.

Corvallis, Ore.—Council has decided to pave 4 additional streets, aggregating about 30 blocks.

Rich Hill, Wis.—Brick paving is contemplated for S. Washington and S. Walnut sts. Cy. clk. Metz.

Bellingham, Wash.—The city council has decided to readvertise for bids for paving Magnolia ave.

Snohomish, Wash.—Asphalt paving is contemplated from the Eagles' Hall to the Northern Pacific depot.

Williston, N. D.—Council is considering a petition to construct sidewalks in several streets.

Waukegan, Ill.—Mineral rubber asphalt paving is contemplated for Park ave. north of Washington st.

Tacoma, Wash.—Council has authorized the construction of cement walks around N. 35th and Cheyenne sts.

Dodge Center, Minn.—The construction of sidewalks is contemplated in several streets. Vil. coun.

Philadelphia, Pa. — Ordinances were passed July 14 for repaving Arch and Catharine sts. with wood blocks.

Bourbon, Ind.—Plans and specifications have been adopted for 5 blocks of paving in Main and Center sts.

East Grand Forks, Minn.—A petition has been presented to council asking for cross and sidewalks in De Mers ave.

Lansing, Mich.—The city engineer estimates the cost of paving Washington st. at $11,150, and Washtenaw ave. at $13,870.

Columbus, O.—An ordinance has been passed providing for paving in 3rd, Frankfort, Lazell and a number of other streets.

North Yakima, Wash.—City council has authorized the construction of 7 blocks of brick and 6 blocks of asphalt paving.

Browns Valley, Minn.—The village council has authorized the construction of sidewalks in several streets.

Sioux Falls, S. D.—Council has passed a resolution providing for the construction of cement curb and gutter.

Colorado, Tex.—This city voted to issue $30,000 bonds for improving about 9 sq. mis. within this city.

Monroe, Mich.—Bids will be asked, as soon as funds are available, for paving. T. E. White, cy. engr.; L. J. Humes, cy. clk.

Marshalltown, Ia.—The brick specifications are to be revised. Action will be taken in January preparatory to asking for bids for concrete paving.

Hastings, Neb.—The city engineer has been directed to prepare plans and specifications for brick paving in Lincoln ave., from 9th to 12th.

Visalia, Cal.—The property owners in W. Main, S. Church, Acequia, Garden, Locust, Center, Court and Oak sts. are in favor of asphalt paving.

Peoria, Ill.—Creosoted wood block paving is proposed now for Adams st. from Hamilton to Bridge sts. Perry ave. will be resurfaced with asphalt.

Pipestone, Minn.—Council will consider a resolution Aug. 8 for the construction of sidewalks.

Wichita, Kas.—Resolutions have been passed providing for Hassam paving in Morris st. and vitrified brick paving in an alley. Wm. Sence, cy. clk.

Oakland, Cal.—The park commissioners have directed the city engineer to prepare plans and specifications for sidewalks on the Lake Shore boulevard.

Meridian, Miss.—The bd. of supvrs. has voted to issue $200,000 bonds for constructing good roads. B. V. White, C. C. Dunn, T. C. Kinard, road comrs.

Swanville, Minn.—An ordinance has been passed for constructing sidewalks and crosswalks.

Dallas, Tex.—The property owners in Live Oak st. have petitioned for permanent paving.

Ft. Scott, Kas.—The construction of 20 blocks of brick paving is contemplated. Plans are being prepared for constructing a macadam road. Wm. McElroy, cy. engr.

Cedar Rapids, Ia.—Bids will be asked for soon for constructing 11,000 sq. yds. of vitrified brick paving in Grand ave. Mat. Miles, mayor; T. F. McCaulley, cy. engr.

Red Oak, Ia.—The improvement of streets, alleys and street intersections is contemplated.

Edmonds, Wash.—Special.—C. A. Messimer, cy. engr., advises us that plans and estimates have been filed for about 6,000 ft. of concrete walks and gutters in 3rd st.

Omaha, Neb.—Asphalt paving has been favorably decided upon for Dundee, the district lying between Dodge and Underwood sts., from 48th to 52nd sts. The board of trustees will let the contracts soon.

Baltimore, Md.—The residents along Evergreen Terrace are urging the bd. of est. to pave the roadway in front of Druid Hill Park, along Oren Place and Evergreen Terrace with asphalt.

Davenport, Ia.—A resolution has been passed providing for the construction of 1,018 sq. yds. of vitrified brick paving on concrete base, and 1,001 sq. yds. of concrete paving. Alfred C. Mueller, mayor.

Smithville, Tex.—At a recent meeting of the Ten Thousand Club, a good roads movement was inaugurated that, in connection with the work of the county commissioners, will insure first-class roads in the territory around this town.

Wethersfield, Ill.—The construction of cement sidewalks is contemplated in a number of streets. Vil. bd. trustees.

Hammond, Ind.—Objections will be heard Aug. 3 on proposed paving of an alley with vitrified brick. Adam R. Ebert, prest. B. P. W.

Moline, Ill.—Brick paving is contemplated for 3rd ave. and 15th st. Clark Anderson, cy. engr.

Dayton, O.—A resolution has been adopted to macadamize Covington pike.

Toledo, O.—A resolution has been approved for improving Central ave. from the Lake Shore tracks to Auburn ave., with tar macadam.

Texarkana, Ark.—Paving is contemplated for Pine st.

Tiffin, O.—A resolution has been adopted to pave W. Market st. with brick or Westrumite.

Barnesville, O.—A resolution has been passed to pave Church st. between Arch st. and N. Lincoln ave.

Troy, Pa.—An ordinance has been passed to pave W. Main st. and reconstruct Short st.

Columbus, O.—Ordinances have been passed for paving Reeb and Barthman aves. with vitrified brick or block. Geo. S. Marshall, mayor.

Buffalo, N. Y.—A resolution has been approved providing for the repair of all asphalt pavements out of guaranty and not beyond repair, until such time as the city shall have established a municipal asphalt repair plant. Resolutions have been approved for repaving Bryant st. and Woodlawn and West aves. with asphalt; Broadway with block Medina sandstone.

Knightsville, Ind.—The construction of many new cement sidewalks is contemplated.

CONTRACTS TO BE LET.

Cando, N. D.—Bids are asked until Aug. 15 for 80 rods of grade. Frank Shanley, co. audt.

Fayetteville, W. Va.—Bids are asked until Aug. 10 (readv.) for road work. Henry A. Gentry.

Leland, Wis.—Bids are asked until 12 m. Aug. 2 for constructing sidewalks. R. W. Garrison, mayor.

Peru, Ind.—Bids are asked until Aug. 3 for constructing 9 gravel roads. Chas. Griswold, co. audt.

Dallas, Tex.—Bids are asked until Aug. 11 for paving Scott st. road. John B. Ashe, co. audt.

Leland, Miss.—Bids are asked until Aug. 2 for constructing sidewalks. R. W. Garrison, mayor.

Vincentown, N. J.—Bids are asked until Aug. 4 for building a stone road. Wm. T. Joyce, clk. South twp.

Marion, Ind.—Bids are asked until Aug. 2 for building gravel roads. Andrew Y. Stout, co. audt.

Winamac, Ind.—Bids are asked until Aug. 2 for improving 5 public highways. Ellis S. Rees, co. audt.

Wabash, Ind.—Bids are asked until Aug. 2 for constructing gravel roads. J. P. Noftzger, co. audt.

Valparaiso, Ind.—Bids are asked until Aug. 8 for constructing gravel roads. Stephen B. Corboy, co. audt.

Washington, Ind.—Bids are asked until Aug. 6 for constructing a gravel road. Thos. Nugent, co. audt.

Vincennes, Ind.—Bids are asked until Aug. 2 for constructing a gravel road. John T. Scott, co. audt.

Mt. Gilead, O.—Bids are asked until Aug. 5 for constructing 1.75 mis. of road. Clifton Life, co. audt.

Bloomfield, Ind.—Bids are asked until Aug. 2 for constructing a macadam road. Peter M. Cooke, co. audt.

Crawfordsville, Ind.—Bids are asked until Aug. 2 for constructing a macadam road. Bennett B. Engle, co. audt.

Decatur, Ind.—Bids are asked until Aug. 4 for constructing a macadam road. H. S. Michaud, co. audt.

Tipton, Ind.—Bids are asked until Aug. 6 for constructing 5 stone roads. J. F. Barlow, co. audt.

Frankfort, Ind.—Bids are asked until Aug. 6 for constructing 15 gravel roads. F. Cromwell, co. audt.

Antigo, Wis.—Bids are asked until Aug. 6 for 4 blocks of macadam paving. G. O. Palmetar, cy. clk.

Loup City, Neb.—Bids are asked until Aug. 12 for constructing cement sidewalks. Peter Rowe, cy. clk.

Two Harbors, Minn.—Bids are asked until Aug. 15 for grubbing a county road. John P. Paulson, co. audt.

Olathe, Kas.—Bids are asked until Aug. 10 for building Kansas City-Olathe rock road, 18 mis. long. Bd. co. comrs.

Ft. Scott, Kas.—Bids are asked until Aug. 5 for building 22 mis. of Kansas City-Ft. Scott road. Cy. comrs.

Ft. Howard, Md.—Bids are asked until Aug. 15 for constructing macadam roads, concrete walks, etc. Constr. Q. M.

Martinsville, Ind.—Bids are asked until Aug. 2 for constructing gravel roads. B. E. Thornburg, co. audt.

Cincinnati, O.—Bids are asked until Aug. 12 for shaping up Reading Pike ready for oiling. Fred Dreihs, clk. co. comrs.

Bridgeton, N. J.—Bids are asked until 2 p. m. Aug. 2 for improving 5.39 mis. of Malaya road. W. M. Sharp, co. engr.

La Moure, N. D.—Bids are asked until Aug. 9 for constructing a cement sidewalk at the school house. F. P. Bennett, clk.

Huntington, W. Va.—Bids are asked until Aug. 11 for paving Maple ave., 26th st. and an alley with brick. John Coon, supt. sts.

Dayton, O.—Bids are asked until Aug. 4 for grading and macadamizing 2.64

mis. of Xenia Pike. Frank Munger, chm. co. comrs.

Binghamton, N. Y.—Bids are asked until Aug. 3 for paving Henry and Court sts. with brick. S. W. Murray, clk. bd. contr. and sup.

Pensacola, Fla.—Bids are asked until Aug. 19 for constructing 526,000 sq. ft. concrete sidewalks. L. Earle Thornton, cy. engr.

Canton, O.—Bids are asked until Aug. 5 for draining, grading and paving with brick, 2.54 mis. of road. J. H. McConnell, co. audt.

Decatur, Ala.—Bids are asked until Aug. 9 for macadamizing 10 mis. of county road. R. P. Boyd, co. engr., Box 173, New Decatur.

Gulfport, Miss.—Bids are asked until 8 p. m. Aug. 2 for constructing 13,000 sq. yds. of cement sidewalks. H. D. Shaw, cy. engr.

Pensacola, Fla.—Bids are asked until Aug. 10 for constructing 525,000 sq. ft. of concrete sidewalks. L. Earle Thornton, cy. engr.

Holland, Mich.—Bids are asked until Aug. 3 for 1200 sq. yds. of brick paving and 4600 ft. of curb and gutter. H. A. Naberhuis, cy. engr.

Sherman, Tex.—Bids are asked until Aug. 10 for constructing about 65 mis. of macadam roadway in road dist. No. 1. H. R. Wallace, co. audt.

Oakland, Cal.—Bids are asked until 2 p. m. Aug. 4 for constructing an asphalt roadway in Lakeside Park. Henry F. Vogt, secy. park com.

Columbus, O.—Sealed bids are asked until Aug. 4 for grading and macadamizing 3.71 mis. of road in Licking county. James C. Wonders, state highway comr.

East Chicago, Ind.—Bids are asked until Aug. 5 for improving 5 streets and constructing 20 mis. of cement sidewalk. C. K. Wallace, cy. engr.

Merchantville, N. J.—Bids are asked until Aug. 19 for constructing an Amiesite road .85 mi. long in Chapel ave. Bd. chosen freeholders, Camden.

Pittsburg, Pa.—Bids are asked until Aug. 3 for the permanent improvement of several public roads and highways. R. J. Cunningham, co. contr.

New Brunswick, N. J.—Bids are asked until Aug. 4 for grading cut-off of Donnell's Hill, N. Brunswick twp. P. H. S. Hendricks, dir. freeholders.

Cleveland, O.—Bids are asked until Aug. 10 for grading, draining and improving Broadview road No. 4. John F. Goldenbogen, clk. B. P. S.

Alexandria, La.—Bids are asked until Sept. 6 for paving Gould ave., from 11th to Levin st., with vitrified brick, and to city limits with gravel. Bd. ald.

Villisca, Ia.—Sealed bids are asked until Aug. 3 for paving and curbing 3rd ave., requiring 20,542 sq. yds. of paving and 7818 ft. of curbing. Geo. B. Sexton, cy. clk.

Naperville, Ill.—Bids will be asked about Oct. 1 for 61,850 sq. yds. of macadam bituminous filled pavement; 39,370 ft. cement curb; 16,000 cu. yds. grading; 13,000 ft. of drainage. W. S. Shields Co., engrs., Hartford Bldg., Chicago.

Frankfort, Ky.—Sealed bids are asked until 12 m. Aug. 2 for constructing brick and concrete walks, cut stone and storm water drainage at the new State Capitol Building. Edward M. Drane, secy. bd. state capitol comrs.

Ft. Riley, Kas.—Bids are asked until Aug. 11 for constructing 4500 cu. yds. grading; 6600 sq. yds. macadam road; 3900 lin. ft. concrete driveway curb; 6 concrete catchbasins; 500 lin. ft. 12-in. culvert pipe; 8000 sq. ft. concrete sidewalks; 950 sq. ft. concrete walk crossing road, concrete steps, etc. Capt. W. M. Whitman, constr. Q. M.

Davenport, Ia.—Bids are asked until Aug. 2 for paving an alley and Western ave. and Brown and Case sts. with vitrified brick. A. M. Compton, chm. B. P. W.

Akron, O.—Bids are asked until Aug. 11 for improving E. Market road. Chas. L. Wirth, clk. co. comrs.

St. Joseph, Mich.—Bids are asked until Aug. 3 for paving Broad st. with brick on sand foundation. Matthias Weber, cy. clk.

Logansport, Ind.—Bids are asked until Aug. 2 for paving 5th st. with brick. B. P. W.

Independence, Kas.—Bids are asked until Aug. 12 for macadamizing Rook road. Co. comrs.

Chicago, Ill.—Bids are asked until Aug. 2 for paving a large number of streets with vitrified brick, granite blocks, asphalt, etc. Albert Keeney, prest. bd. local impvts.

Oakland, Cal.—Bids are asked until Aug. 4 for constructing an asphalt roadway in Lakeside Park. Henry F. Vogt, secy. park comn.

Coeur d'Alene, Idaho.—Bids are asked until Aug. 8 for paving in districts Nos. 12 and 13.

Seattle, Wash.—Bids are asked until Aug. 5 for grading and regrading 12th ave. S., et al. B. P. W.

CONTRACTS AWARDED.

Alton, Ill.—V. Wolf was awarded a contract for paving Danford st. with vitrified brick.

Spokane, Wash.—P. J. McHugh was awarded a contract for paving Lakeview ave. for $32,649.

Buffalo, N. Y.—The contract for street repairs was awarded to the Barber Asphalt Paving Co.

Portland, Ore.—The Hassam Paving Co. was awarded a contract for paving Lombard st. for $127,545.

Carrollton, O.—A paving contract has been awarded Coss & Myers, of Wheeling, W. Va., for about $42,000.

Spokane, Wash.—The contract for paving Mission ave. was awarded to the Barber Asphalt Paving Co. for $84,500.

Wilmerding, Pa.—W. E. Howley was awarded a contract for macadamizing the old Monroeville road for $22,398.

London, Ont.—The contract for resurfacing Dundas st. was awarded to the Barber Asphalt Paving Co. for $12,716.

Boston, Mass.—The contract for constructing artificial stone sidewalks in the public streets was awarded to C. W. Dolloff & Co. and John Landis.

Buffalo, N. Y.—Special.—Henry P. Burgard was awarded a contract for paving Sycamore st. for $38,500. Robert Seibert was awarded a contract for constructing concrete sidewalks for 1 yr., at 7½ cts. a sq. ft.

Covington, Ind.—Haynes & Waymore, of this city, secured a contract, July 5, for constructing gravel roads.

Carmi, Ill.—The contract for paving was awarded to A. W. Eisenmayer of Granite City, Ill., for $60,000.

Sapulpa, Okla.—The contract for asphalt paving was awarded to the Peters Bros. Paving Co. for $40,000.

Helena, Mont.—Louis Johnson was awarded a contract for improvements in the 4th ward impvt. dist., for $74,121.40.

Paulding, O.—The coitract for macadamizing Auglaize pike was awarded to

the Lewisburg Stone Co., of Lewisburg, for $29,961.

Clarksburg, W. Va.—The contract for street paving was awarded to the Concrete Construction Co. for about $30,000.

Troy, N. Y.—McKenna & Walsh secured the contract for paving Douw st. with Mack brick at $2.29 a sq. yd. or $5,873.

Hot Springs, Ark.—The contract for paving Benton st. with blocks was awarded to the Zincoli Pole Co., of Texarkana.

New Britain, Conn.—Special.—The contract for 24,000 sq. yds. of bitulithic paving was awarded to Warren Bros. Co., of Boston.

Trenton, N. J.—Special.—A contract for 14,450 sq yds. of bitulithic paving was awarded to the United Paving Co., of Atlantic City.

Schenectady, N. Y.—The contract for paving Avenue A and Mason st. with asphalt was awarded to the Schenectady Contracting Co.

Tyrone, Pa.—The contract for brick paving on concrete base was awarded to the Central Construction Co., of Harrisburg, at $1.96½ a sq. yd.

Osceola, Ia.—Wm. Horrabin, of Iowa City, was awarded a contract for 13,000 sq. yds. of paving and 8,000 lin. ft. of cement curbing.

El Paso, Tex.—Special.—The Texas Bitulithic Co., of Dallas, was awarded a contract for 35,358 sq. yds. of bitulithic paving here.

Pottsville, Pa.—The contract for paving Centre st. with wood blocks was awarded to H. E. Vare, of Philadelphia, for $67,604.65.

Bloomington, Ill.—The Andrews Asphalt Co. was awarded a contract for resurfacing N. Main st. with asphalt, at $1.28 a sq. yd.

Wheeling, W. Va.—John B. Shannafelt was awarded a contract for 12,000 sq. yds. of paving and 1 mi. of curbing for $15,000.

Peoria, Ill.—Brewster & Evans were awarded contracts, July 18, as follows: Walnut st., brick, $5,001.80; Ellis st., $6,847.60.

Winston, N. C.—Special.—The contract for 4113 sq. yds. of bitulithic paving was awarded to the Atlantic Bitulithic Co., of Richmond, Va.

Greensburg, Pa.—The Hallam Construction Co., of Washington, Pa., was awarded a contract, July 12, for paving 9 sections of highways for $17,000.

Danville, Ind.—Contracts for constructing roads have been awarded as follows: John P. Shut road, L. R. Hiatt, $5200; Todd road, Walt G. Hadley, $4895.

Portland, Me.—The contract for constructing 5340 ft. of bituminous macadam road was awarded, July 15, to the Hassam Paving Co., of Worcester, Mass., for $8257.

Shawnee, Okla.—The contract for constructing 52,000 sq. yds. of paving was awarded to the Metropolitan Construction Co., at $1.99 a sq. yd.

Great Falls, Mont.—The contract for paving 10 blocks of the principal streets was awarded to Flinn & Hanlon, of Sioux City, Ia., for $80,000.

Vinton, Ia.—The contract for paving the entire business district with brick was awarded to Mike Ford, of Cedar Rapids, at $1.74½ a sq. yd.

Dallas, Tex.—The Municipal Paving Co. submitted the lowest bid, July 13, for as the lowest bid exceeded the special resurfacing the streets surrounding the county court house, for $12,862.50.

Atlantic City, N. J.—Special.—The contract for constructing 18,770 sq. yds. of bitulithic paving was awarded to the United Paving Co., of this city.

Vancouver, B. C.—Special.—The contract for 30,000 sq. yds. of bitulithic paving was awarded to the Warren Construction Co., of Portland, Ore.

Dallas, Tex.—Special.—The Texas Bitulithic Co. has been awarded 2 contracts for bitulithic paving comprising 9227 and 5905 sq. yds. respectively.

Berlin, Ont.—Special.—The Warren Bituminous Paving Co., of Toronto, Ont., was awarded a contract for 11,117 sq. yds. of bitulithic paving.

Wilmington, Del. — Special. — Warren Bros. Co., of Boston, secured a contract for 30,000 sq. yds. of bitulithic paving in this city.

Chicago, Ill.—The Citizens' Construction Co. was awarded contracts, July 8, for creosoted block paving in Adams, Congress, La Salle and Monroe sts., for $65,000.

Richmond, Ind.—John F. Cronin & Co. secured a contract, July 11, for constructing a gravel road, with asphaltic cement dressing, for about $54,500.

Indianapolis, Ind.—The contract for paving Daly st. from Cruse to Pine, with brick, was awarded, July 11, to the American Construction Co., at $3.25 a lin. ft.

Chehalis, Wash.—The Warren Construction Co. was awarded a contract for 25,763 sq. yds. of paving in Pacific and Chehalis aves. and Market st., for $91,100.

Columbus, O.—Sidewalk contracts at the Columbus Barracks have been awarded as follows: Cement sidewalks, Acme Paving Co.; brick sidewalks, 5212 sq. yds., D. E. Sullivan.

Avalon, Pa.—The contract for grading, paving and curbing Chestnut st. was awarded to Michael O'Herron for $5,317.20, and for Locust st., to Ott Bros., for $6215.10.

Sheridan, Wyo.—The contract for paving Main and other streets with creosoted wood blocks was awarded, July 20, to Jas. Kennedy, of Fargo, N. D., for about $310,000.

Redding, Cal.—Contracts have been awarded as follows: Completing w. s. of road from Kennett to Antler, division 1, Chris. Stabler, $10,929; division 3, Matt Wengler, $11,250.

Great Falls, Mont.—The contract for constructing 10 blocks of creosoted wood block paving in the down town district was awarded to the Kettle River Company, of Minneapolis, for $69,989.76.

Princeton, Ind.—The contract for improving Broadway and Haier sts. under the township road law was awarded to W. Ewing Sheilds, of Seymour, for $17,286.24 and $24,574.82 respectively.

Ft. Dodge, Ia.—The contract for constructing 17 blocks of concrete paving was awarded to the North Star Concrete Co., of Mankato, Minn., and the St. James Tile Mfg. Co., for about $52,000.

Norfolk, Va.—The contract for paving and curbing 12th st. between Williams ave. and the cemetery gate was awarded to P. J. Looney, at 38 cts. a sq. yd. and 8 cts. a ft. for curbing.

Portland, Ore.—Special.—Contracts for bitulithic paving have been awarded as follows: Warren Construction Co., Portland, 30,043 sq. yds.; Pacific Bridge Co., Portland, 8928 sq. yds.

Canton, Ill.—The contract for constructing a road in dist. No. 5 was awarded to M. Heckard & Son, of this city, as follows: Excavating, 46 cts.; brick, $1.58 a sq. yd.; curbing, 21 cts. a lin. ft.; total, $32,825.08. Roller & Saville, city secured

the contract for constructing a road in dist. No. 6, as follows: Excavating, 46 cts.; brick, $1.59; curbing, 21 cts.; total, $67,630.85.

Memphis, Tenn.—The contract for resurfacing all of the old brick pavements in the down town business district with natural lake asphalt was awarded to the Memphis Asphalt & Paving Co., for $34,000.

Tacoma, Wash.—The Keasel & McDowell Logging Co. was awarded a contract for paving Commerce st. with stone blocks, for $15,000. Joseph Warter & Co. secured the contract for asphalt paving in an alley.

Buffalo, N. Y.—Robert Seibert was awarded the contract, July 14, for constructing and repairing concrete sidewalks at 7½ cts. a sq. ft. The German Rock Co. secured the contract for paving Carroll st. for $9220.

New Orleans, La.—The Barber Asphalt Paving Co. was awarded contracts, July 11, as follows: Repaving Burdette st. with asphalt, $12,995; paving Bienville st., $12,781.90; Alexander st., asphalt, $36,227.

Superior, Wis.—The contract for paving Banks ave. with crushed rock on top of the cedar block pavement was awarded to Peterson & Holm for $10,797.15; Lund & Co. secured a contract for constructing 2 mls. of cement sidewalks.

Erie, Pa.—Paving contracts were awarded, June 27, as follows: 7th st., Mayer Bros., Class B asphalt, $1 a sq. yd.; concrete base, 46 cts.; E. 3rd st., McCormick & Son, Bessemer block, $1.52 a sq. yd.; 14th st., F. J. Eichenlaub, brick, $1.05.

Chattanooga, Tenn.—The West Construction Co. was awarded the contract, June 28, for paving Chestnut st. with asphalt and Wyatt st. with asphalt macadam. The Noll Construction Co. was awarded a contract for paving Main and 9th st. with brick.

Pasadena, Cal.—The contract for curbing, guttering and oil macadam paving in Villa st. was awarded to the John R. Ott Construction Co. for $24,650, and Lake ave. for $14,350. Andrew Holloway was awarded the contract for oil macadam in Center st. for $12,300.

Trinidad, Colo.—John A. Laughlin was awarded a contract for paving Animas st. and Grant ave. with asphalt macadam, at $1.25½ a sq. yd.; concrete curb, 70 cts. a lin. ft.; concrete gutter, 40 cts.; oak headers, 40 cts.; draining, including outlet, $11,097; total, $24,000.

Pekin, Ill.—Jansen & Zoller, of this city, secured the contract, July 11, for paving Park ave. with mineral rubber for $4,587. The contract for paving 3rd st. and 3rd st. place with brick with asphalt filler was awarded to the Illinois Cement Construction Co., of Springfield, for $4,500.

Indianapolis, Ind. — Contracts were awarded, July 7, as follows: Sherman drive, asphalt, Marion County Construction Co., $3 a lin. ft. each side; cement walks, Washington st. from Jefferson to Beville, Wm. H. Hall, 15½ cts. a sq. ft.; Ruckle st., Lackey Bros., 13 cts.; Denny st., Henry Polthast, 15 cts.; Addison st., M. Saperie, 14 cts.; Grace st., J. D. Hoss, 15 cts.

Waukesha, Wis.—Special. — The Advance Construction Co., of this city, was awarded a contract, July 11, for 31,000 sq. yds. of tar macadam and 5770 sq. yds. of brick paving, for $51,347.28. The other bids submitted were as follows: Marquette Construction Co., of Chicago, $52,347.28; A. J. Hewitt, Milwaukee, $53,305.64; J. Stanchfield, Fond du Lac, $54,219.09; Miracle Construction Co., Minneapolis, $7,010.24.

Detroit, Mich.—Paving contracts were awarded, June 29, as follows: Shipherd ave., brick, T. E. Currie, $1,263.43; alley 185, James Hanley, $985.61; alley 186, James Hanley, $1,373.60; alley 187, T. E. Currie, $2,013.69; alley 188, R. T. Baker Co., $1,672.66; alley 189, R. T. Baker Co., $3,606.22; Butternut street, cedar, Ferdinand Porath & Sons, $5,916.49; Hudson ave., cedar, J. Porath, $2,338.58; Waterloo st., cedar, H. W. W. Hatch & Sons, $2,072.94; McGraw ave., concrete, J. Porath, $6,048.04; 23rd st., concrete, J. Porath, $6,750.32.

Hartford, Conn.—Contracts for constructing state road work were awarded, July 11, as follows:

Town of Plainville, 7298 lin. ft. macadam-telford, including one 15-in. tile pipe culvert, 14-ft. roadway, to O. T. Benedict, Pittsfield, Mass., at $8,685 for macadam and 79 cts. per lin. ft. extra for telford, and 75 cts. for rubble drain.

Town of Farmington, 9,104 lin. ft. macadam-telford, including one 12-in., two 15-in. and two 18-in. tile culverts and a reinforced concrete arch culvert, 14-ft. roadway, to O. T. Benedict, Pittsfield, Mass., at $14,475 for macadam and 60 cts. per lin. ft. extra for telford and 75 cts. for rubble drain.

Town of Warren, 1900 lin. ft. graded telford road, including two 15-in. and one 24-in. tile pipe culverts, 14-ft. roadway, to Goodman & Trumbull, Litchfield, Conn., at $2622 for grading, 90 cts. per lin. ft. extra for telford and rubble drain.

Town of Bolton, 3640 lin. ft. graded telford road, including one 12-in. tile culvert, 14-ft. roadway, to Goodman & Trumbull, Litchfield, at $4280 for grading and 90 cts. per lin. ft. extra for telford and rubble drain; 60 cts. per sq. yd. for cobble gutters.

Town of Avon, 7700 lin. ft. macadam-telford road, including five 24-in., four 18-in. and one 15-in. tile culverts and one reinforced concrete arch culvert, 14-ft. roadway, to Peter Suzio, Hartford, at $30,000 for macadam, $2.40 per lin. ft. for telford, $1.65 for rubble drain, 60 cts. per sq. yd. for cobble gutters.

Town of West Hartford, 9885 lin. ft. macadam-telford road, including one 20-in., five 18-in., two 15-in., and three 12-in. tile culverts, 14-ft. roadway, to Peter Suzio & Co., Hartford, at $38,551 for macadam, $2.40 for telford, $1.65 for rubble drain, 60 cts. per sq. yd. for cobble gutters.

Town of Mansfield, first section, 1600 lin. ft. gravel-telford road, 16-ft. roadway, to H. L. M. Ladd, New London, at $2900 for grading and 60 cts. per lin. ft. for telford; second section, 2500 lin. ft. graded telford road, including two 20-in. tile culverts, 16-ft. roadway, to Clayton & Curtiss, Glastonbury, Conn., at $6875 for grading, 75 cts. per lin. ft. for telford. All bids for the third section, 13,941 lin. ft. on the Storrs Colle road, were rejected, appropriation made for this work.

Town of Winchester, 10,750 lin. ft. macadam-telford road, including ten 15-in., five 18-in., five 20-in., and three 24-in. tile culverts, 14-ft. roadway, to John De Michiel & Bro., Torrington, Conn., at $3.36 per lin. ft. for macadam; $3.80 per lin. ft. for telford, $1 for rubble drain and $5 per cu. yd. for masonry walls.

SEWERS.

CONTEMPLATED WORK.

Alturas, Cal.—A sewerage system is contemplated.

Willmar, Minn.—Bonds will be issued for constructing sewers.

Pasco, Wash.—A new sewerage system is contemplated.

Springfield, Minn.—A sewer in Van Buren st. is proposed.

Dubuque, Ia.—A sanitary sewer in Grandview ave. and Dodge st. is contemplated.

Wolsey, S. D.—The question of a modern sewerage system is being urged.

Albany, Ore.—The extension of the sewerage system is contemplated.

Yukon, Okla.—Voted to issue bonds to construct a sewerage system.

Pullman, Cal.—Surveys will be made for constructing a sewer system.

Sigourney, Ia.—Plans will be prepared for installing a sewerage system.

Chambersburg, Pa.—The installation of a sewerage system is being urged.

Klamath Falls, Ore.—The city council voted to issue $5,000 sewer bonds.

Sandusky, Mich.—The installation of a sewerage system is contemplated.

Mankato, Minn.—Council has decided to rebuild the Vine st. sewer.

Willow Lakes, S. D.—The construction of a sewerage system is contemplated.

Erwin, Tenn.—Voted to issue bonds for sewer construction and street improvements.

Arlington Heights, Ill.—Plans will be prepared for a septic tank and sewer system.

Yorkville, N. Y.—Plans and specifications have been prepared for a sewerage system.

Provo, Utah.—An ordinance has been passed to construct a sewer in district No. 11.

Kennewick, Wash.—Plans have been prepared for a sewerage system to cost $85,000. Engr. Hanford.

Heron, S. D.—Council has been presented with a petition asking for a sewer in Wisconsin st.

Vancouver, B. C.—Will vote Aug. 20 on the question of issuing $40,000 bonds for sewer construction.

Bloomfield, Ind.—The construction of a sewer in Mechanic st. is contemplated. Bd. trustees.

Ellensburg, Wash.—Plans have been completed for an extensive sewer system. G. N. Miller, cy. engr.

Marinette, Wis.—Council proposes to enlarge the 15-in. sewer from Ella court to the Menominee river.

Glasgow, Mont.—Special.—E. S. Severance desires to purchase automatic syphon for sewer flush tanks.

East Grand Forks, Minn.—Plans and specifications have been prepared for constructing a sewerage system.

Sioux Falls, S. D.—Plans have been adopted by the board of county commissioners for the proposed west side sewer district.

Twin Falls, Idaho.—Bids will be asked about September for constructing pipe sewers. Stuart H. Taylor, cy. clk.

Anamosa, Ia.—A resolution has been passed for constructing a sanitary sewer in Gamarillo st. Robert Johnson, mayor.

Spencer, Ia.—A resolution will come up for passage and adoption, Aug. 19, for constructing a sewer. R. L. Taylor, cy. clk.

Council Bluffs, Ia.—A resolution has been passed providing for the construction and reconstruction of sewers in certain streets and avenues. Thos. Maloney, mayor.

Akron, O.—A bond issue is proposed for the construction of a main trunk sewer in Euclid, Ira and Cole aves. W. T. Sawyer, mayor.

Ft. Madison, Ia.—Action will be taken Aug. 1 on the proposed construction of a sanitary sewer in several streets.

Norman, Okla.—Special.—J. W. Klingensmith requests the price of automatic sewage lifting station equipment.

Owatonna, Minn.—A petition has been submitted to council asking for the construction of a new sewer system.

Lansing, Mich.—The city engineer has been directed to prepare plans for a sewer in Franklin ave. and Clark st.

Vancouver, B. C.—The city engineer has submitted plans for constructing a sewerage system in the southeastern part of town.

Brinkley, Ark.—This city will construct 8 mis. of sewers this summer.

Ellisville, Miss.—The installation of a sewerage system is contemplated.

Madison, S. D.—Plans will be prepared for constructing a sewerage system.

Princeton, Ill.—The construction of 2 new sewerage districts is contemplated.

Antigo, Wis.—Plans have been submitted to council for a septic tank for sewage disposal.

Duluth, Minn.—The Woodland trunk sewer will be constructed at an estimated cost of $138,352.

Masontown, Pa.—This city voted to issue $25,000 bonds for the construction of a sewerage system.

Bay City, Tex.—The question of organizing drainage district No. 2 of Matagorda county will be voted on.

Lake Charles, La.—This city voted to issue bonds for the construction of a complete sewerage system.

West Salem, Wis.—The village council will take action Aug. 2 on the construction of a sewerage system.

Marion, Ind.—Plans and specifications will be prepared for building a sewer between Washington and Branson sts.

Pocatello, Idaho. — Special. — W. A. Samms, cy. engr., says this city voted to construct trunk line sewers.

Terre Haute, Ind.—An ordinance has been passed providing for the issue of bonds for constructing sewers.

Wilmar, Minn.—The city council has again voted to issue bonds for the construction of a sewerage system.

Pontiac, Mich.—Objection will be heard Aug. 8 on the proposed construction of certain lateral sewers. Jos. H. Thorpe, cy. clk.

Columbus, Ind.—A petition is being circulated asking for the construction of a sewer in 16th st. from Washington st. to Home ave.

St. Joseph, Mo.—City engineer Lawler has been directed to inspect the Blacksnake sewer from its mouth to Middleton st. with a view to its improvement.

Hazleton, Pa.—In compliance with the demand of the State health department, this city will be required to construct a sewer system and sewage disposal plant.

Kansas City, Kas.—Ordinances have been passed for constructing a sewer in sub-sewer district No. 8 in sewer district No. 1 (Argentine). J. E. Porter, mayor.

Mobile, Ala.—Preliminary surveys are being made for the establishment of a perfect sewer and sanitary arrangement in all of the suburbs adjoining this city.

Evansville, Ind.—A resolution has been adopted providing for the construction of a main sewer in Maryland st. and Hess

ave. Simon A. Bartholome, clk. B. P. W.

Flint, Mich.—Plans have been prepared for the construction of sanitary sewers in Baker and Taylor sts. and a storm water sewer in Industrial ave.

New York City.—Plans have been authorized by the board of estimate and apportionment for constructing a system of sewer mains for the benefit of the Richmond Hill and Ridgewood Heights sections.

Fulton, N. Y.—Plans and specifications for a partial reconstruction of the 15-in. vitrified pipe sewer alongside the 36-in. drain now being built by the State at Upper Landing have been completed.

East Moline, Ill.—H. G. Paddock, cy. engr., has been directed to prepare estimates of the cost of extending sewer service into new territory south of the Rock Island and Burlington tracks between 10th and 13th sts.

Modesto, Cal.—Plans and specifications have been submitted by Geo. H. Freitas, cy. engr., and Robert H. Goodwin, cons. engr., for the proposed new sewerage system. The board of trustees will call an election to vote on a $70,000 bond issue.

CONTRACTS TO BE LET.

Logansport, Ind.—Bids are asked until Aug. 2 for constructing a sewer in Miles st. B. P. W.

Battle Creek, Ia.—Bids are asked until Aug. 16 for constructing a sewerage system. E. E. Carlson, engr.

New Castle, Ind.—Bids are asked until Aug. 13 for constructing a drain. Chas. E. Byrkett, drainage comr.

Hammond, Ind.—Bids are asked until Aug. 3 for constructing a vitrified pipe sewer. Adam R. Ebert, chm. B. P. W.

Harlan, Ia.—Bids are asked until Aug. 10 for constructing 5½ mis. of drainage ditch. Albert Hansen, co. audt.

Winnemucca, Nev.—Bids are asked until Aug. 2 for constructing a sewerage system. C. W. McDied, clk. bd. co. comrs.

Horton, Kas.—Bids are asked until 8 p. m. Aug. 2 for constructing a main sewer and purification plant. B. B. Norris, cy. clk.

Hawarden, Ia.—Bids are asked until Aug. 3 for constructing 1500 ft. 8-in., 800 ft. 10-in., and 2600 ft. 12-in. sewer. T. J. Reeves, clk.

Pasadena, Cal.—Bids are asked until Aug. 9 for constructing a sewer system, laterals, flushtanks and manholes. W. L. Brown, cy. engr.

Binghamton, N. Y.—Bids are asked until 4 p. m. Aug. 3 for constructing a sewer in Alice st. S. W. Murray, clk. bd. contr. and sup.

Cleveland Heights, O.—Bids are asked until Aug. 9 for constructing sewers, water mains, etc. H. H. Canfield, vil. clk.

Huntington, W. Va.—Bids are asked until Aug. 11 for constructing sewers in 2 streets and 3 avenues. A. P. Maupen, cy. engr.

Ventnor City, N. J.—Bids are asked until 8 p. m. Aug. 3 for constructing sewage disposal works. W. I. Risley, cy. engr.

Hoquiam, Wash.—Bids are asked until Aug. 3 for constructing sewers, gravel roads, etc., on 9th, 10th, 8th and M sts. Cy. clk.

Ft. Crocket (Galveston), Tex.—Bids are asked until Aug. 22 for constructing a sanitary sewer system and sewage pumping plant. P. Whitworth, Capt. Q. M.

Washington, D. C.—Bids are asked until Aug. 3 for furnishing sewer and water pipe to be delivered at Leavenworth, Kas. R. V. LeDow, supt. prisons, Washington, D. C.

St. Petersburg, Fla.—Bids are asked until Aug. 11 for constructing 1800 ft. 16-in. c. i. flange outlet sewer pipe in Tampa Bay. M. W. Spencer, cy. engr.; W. F. Divine, cy. clk.

Laporte, Ind.—Bids are asked until Aug. 8 for constructing 7300 ft. 10-in., 1600 ft. 12-in., 1400 ft. 15-in., 944 ft. 18-in., and 1307 ft. 24-in. sewers. Ezra E. Shoecraft, cy. engr.; F. F. Kmeyer, cy. clk.

Grand Forks, N. D.—Sealed bids are asked until 4 p. m. Aug. 4 for constructing an 8-in. sewer from the proposed public comfort station in Riverside park. W. V. O'Connor, clk. park bd.

Madison, N. J.—Bids are asked until 8 p. m. Aug. 8 for constructing 12 mis. of sewers, with manholes, flushtanks and other appurtenances. Hering & Fuller, engrs., 170 Broadway, New York City.

Woonsocket, R. I.—Bids are asked until 2 p. m. Aug. 4 for constructing 3600 ft. 8-in. sanitary sewer and appurtenances and about 660 ft. of surface water drain, part pipe and part concrete. Frank H. Mills, cy. engr.

Beaumont, Tex.—Bids are asked until Aug. 2 for constructing 100 lin. ft. 27-in., 1140 ft. 24-in., 1080 ft. 18-in., 5445 ft. 15-in. pipe sewer and 1600 ft. 3.5x3-in. concrete sewer, 1500 ft. brick or concrete sewers. C. L. Scherer, cy. engr.

CONTRACTS AWARDED.

Marion, Ind.—F. M. Benner was awarded a contract for constructing a sewer in 18th st., for $8,430.

Pella, Ia.—W. D. Yeager, of Cedar Rapids, was awarded a contract for constructing sewers, for $7,957.

Bridgewater, S. D.—William Welsh was awarded a contract for constructing a complete sewerage system.

Watertown, N. Y.—Hayes & Hodge secured the contract for constructing the new 1st ward trunk sewer, for $18,836.

Huron, S. D.—The Brookings Construction Co. was awarded a contract, July 5, for constructing lateral sewers, for $7,-697.50.

Memphis, Tenn.—T. A. Garvin was awarded a contract for constructing sewers in the Olive st. district, for $11,468.75.

Hutchinson, Kans.—The contract for installing 4 sewers was awarded, July 5, to Davis & Everett, of this city, for $5,-593.21.

Jackson, O.—The contract for building a large sewer was awarded to Elmer E. McConnell, of Kenton, O., for $14,000.

Xenia, O.—The contract for constructing a sewer was awarded to Huonker & Williams, of Springfield, O., for $12,000.

Glencoe, Ill.—Frank R. Mortimer, of this city, was awarded a contract for constructing the South End sewer system, for $41,620.

Pasadena, Cal.—Andrew Holloway was awarded a contract for constructing a septic tank at the municipal sewer farm, for $16,250.

Waukon, Ia.—The contract for constructing a sewerage system was awarded to the Thill-Manning-Whalen Co., of La Crosse, Wis.

Vale, Ore.—The American Light and Water Co., of Kansas City, Mo., was awarded the contract for constructing sewer and water systems.

Phillipsburg, N. J.—Michael O'Hagen was awarded the contract, July 12, for constructing a coscrete surface water sewer in Meadow ave., for $7,000.

Waukegan, Ill.—Sewer contracts were awarded July 1 as follows: Washington st., $4,155.35, and Glen Rock ave., $2,-

234.40, H. C. Patterson; Walter, Jumper and St. James sts., Wm. Davidson, $2,592.25.

Millburn, N. J.—The contract for constructing 9,300 ft. of sewers was awarded, July 18, to Pasquale Maurillo, of Orange, for $7,121.50.

Norwalk, O.—The contract for constructing the joint Huron-Crawford-Richland county ditch was awarded to Gilman Bros., July 9, for $27,000.

O'Neil, Neb.—The contract for constructing a sanitary sewerage system was awarded to Donahue & Peterson, of 15 N. 30th st., Omaha, for $16,507.

Anderson, Ind.—The contract for constructing a cement tile ditch several miles long was awarded to the S. T. Sheets Construction Co., of Paris, Ill., for $17,000.

Burlington, Okla.—The contract for constructing a sanitary sewer system was awarded to the Tonkawa Construction Co., of Tonkawa, Okla., for $33,112.

Missoula, Mont.—The contract for constructing a sewer was awarded, July 14, to Jas. Kennedy, of Fargo, N. D., for $199,000.

Seattle, Wash.—C. J. Erickson was awarded a contract for constructing the Lake Washington division of the North trunk sewer for $720,000.

San Francisco, Cal.—The Metropolis Construction Co., of this city, was awarded a contract for building sewers in 4th and Kentucky sts., for $33,182.

Findlay, O.—The Hancock Stone Co., of this city, was awarded a contract for constructing 5 mis. of storm pipe sewers in Delaware twp. for $16,890.

New York City—O'Leary & Flanagan, 245 E. 202nd st., secured the contarct, July 6, for constructing sewers in Northern ave., for $41,248.

Edwardsville, Ill.—O. T. Dunlap has been awarded a contract for constructing the central outlet sewer along the Steam Mill Branch, at 68½ cts. a ft.

Sandpoint, Idaho.—A. Burns, of Spokane, Wash., was awarded a contract for constructing section No. 1 of district No. 1, of the sewerage system, for $37,597.

Moline, Ill.—The contract for constructing a drainage ditch in Hampton dist. No. 4 was awarded, July 8, to Mathews Bros. & Co., of Erie, for about $15,000.

Elkhart, Ind.—The Northwestern Construction Co. submitted the lowest bids, July 20, for sewer construction, as follows: Elkhart ave., 16,823.60; Kilbourn st., $1,398.10.

Dubuque, Ia.—The contract for constructing a concrete storm sewer, known as the Bee Branch sewer, was awarded, July 7, to the O'Farrell Contracting Co., 79 Clark st.

Boston, Mass.—Sewer contracts have been awarded as follows: Friend st., E. F. Kennedy, Journal bldg., Boston, $3,760; Dartmouth st., Peter W. Hill, Old South bldg., Boston, $19,477.

Norristown, O.—The contract for constructing a sewage disposal and cast iron pipe lines at the State Hospital for the Insane was awarded to the Pitt Construction Co., 821 Fulton Bldg., Pittsburg, for $39,629.

Des Moines, Ia.—T. J. Casselberry was awarded a contract for constructing the E. 10th st. sewer system, at $2 a lin. ft. The Cook Construction Co. secured the contract for the 23rd st. sewer system, at $1.84 a lin. ft.

Indianapolis, Ind.—Sewer contracts were awarded, July 11, as follows: Alley north of 35th st., from Clifton ave. to Barnes ave., Manley-O'Donnell Co., 1,000; alley east of Sherman Drive, American Construction Co., $1,850.

Sabetha, Kans.—Contracts were awarded, July 12, as follows: Sanitary sewers, P. A. Johnson & Co., 437 N. 10th st., S. Kansas City, Kans., $19,206; 2 separate sewage disposal plants, Lewis & Kitchen, 901 Broadway, Kansas City, Mo., $12,500.

St. Louis, Mo.—The George G. Prendergast Construction Co., of this city, was awarded a contract for constructing the first section of the Glaise Creek joint district sewer, as follows: 76,100 cu. yds. excavation, 93 cts.; 7,000 cu. yds. Class A concrete, $7.80; 500 cu. yds. Class C concrete, $7.15; 990 cu. yds. brick masonry, $9; 970 cu. yds. vitrified brick masonry, $9; 430 lin. ft. 6 to 3-in. pipe sewer, 40 cts. to $4; 76,800 lin. ft. ⅜ sq. in. steel bars, 1½ cts.; 178,700 lin. ft. ½ sq. in. steel bars, 2 cts.; 93,300 lin ft. ⅝ sq. in. steel bars, 3¼ cts.; 45,000 lin. ft. ¾ sq. in. steel bars, 4½ cts.; 53,800 lin. ft. ⅞ sq. in. steel bars, 6 cts.; 17,700 lin. ft. 1 sq. in. steel bars, 8 cts.; 164 pieces 6 in. junction slants, $1; 5,400 lbs. cast iron, 3 cts.; 1,250 lbs. wrought iron, 5 cts. Total, $161,616.

WATER WORKS.

CONTEMPLATED WORK.

Ocheyedan, Ia.—A water works system is proposed.

Butler, Wis.—A water works system is contemplated.

Eveleth, Minn.—New water mains are contemplated.

Aiken, Ga.—A water works system is contemplated.

Davis, Cal.—A water works system is contemplated.

Pine City, Minn.—A water works system is contemplated.

Decatur, Neb.—A water works system is contemplated.

Farmington, Minn.—A water works plant is contemplated.

Eureka, Mont.—A municipal water works plant is contemplated.

Norwalk, Wis.—A water works system is contemplated.

Sapulpa, Okla.—A filtration plant will be established.

Anadarko, Okla.—The water works system will be improved.

Twin Falls, Idaho.—A municipal water works system is contemplated.

Clifton, Colo.—The construction of a water works plant is contemplated.

Eau Claire, Wis.—Plans are being prepared for a concrete reservoir.

Hopkinton, Ia.—The extension of the water mains is contemplated.

Brandon, Ore.—Voted to issue bonds for constructing a water works system.

Masontown, Pa.—Voted to issue bonds for constructing a water works system.

Toulon, Ill.—Voted to issue bonds for constructing a water works system.

Prescott, Wis.—Will vote on the installation of a municipal water works system.

Camas, Wash.—Plans for constructing a gravity water system have been made.

Bowbells, N. D.—Voted to issue bonds for constructing a water works system.

Johnson, Neb.—The question of installing a water works system is being urged.

South Omaha, Neb.—The installation of a water works system is contemplated.

Pittsburg, Kans.—Voted to issue bonds for constructing a municipal water works plant.

Centralia, Ia.—Voted to issue bonds for the installation of an ample water supply.

Sioux City, Ia.—A turbine pump is to

be installed near Greenville in the near future.

Payson, Utah.—The estimated cost of installing a water works system is $42,000.

Fairmont, Minn.—Will vote on the issue of bonds for the improvement of the water system.

Murray, Utah.—Voted to issue $20,000 bonds for the improvement of the water work system.

Saginaw, Mich.—Will vote again on the proposition to install a municipal water works plant.

Hartselle, Ala.—Will vote soon on the issue of bonds for constructing a water works system.

Temple, Tex.—The water commission has decided to extend the water mains several miles.

Albert Lea, Minn.—An ordinance has been introduced in council to compel the use of water meters.

New Holland, Pa.—Will vote on the issue of $30,000 bonds for constructing a water works plant.

Cranford, N. J.—The question of establishing a municipal water supply will be voted on.

Denver, Colo.—Will vote Sept. 6 on issue of bonds for constructing a new municipal water plant.

Alliance, Neb.—Plans are being prepared for extensions to the water works and electric light plant.

Emporium, Pa.—Plans and specifications for extending the water works system will be made by H. B. Newton of Ridgeway.

Broken Bow, Neb.—Will vote Aug. 9 on the issue of bonds for the extension of the water works system.

East Dundee, Ill.—Voted to issue bonds for extending and improving the municipal water works system.

Jacksonville, Ore.—Will vote Aug. 1 on the issue of $30,000 bonds for establishing a gravity water system.

Charleston, S. C.—The question of establishing a municipal water and light plant will be investigated. Mayor Rhett.

Logan, Ia.—A new engine, pump and other machinery is to be installed to increase the water supply of this city.

Dillon, Mont.—Council has decided to put in an extra pipe line between this city and the reservoirs. Mayor White.

Parsons, Kas.—The construction of a reinforced concrete reservoir is contemplated. H. H. Parsons, genl. engr. Parsons Water Co.

Springfield, Ill.—The enlargement and improvement of the municipal water plant at a cost of $300,000 has been recommended.

Normal City, Ind.—The constructing of a municipal water works system is contemplated. Address R. Noftzger, atty. for town board.

Newark, O.—An ordinance has been introduced providing for an appropriation of $28,000 for the completion of the municipal water works plant.

La Crosse, Wis.—The construction of a new pumping plant at the La Crosse river in Levee Park has been recommended by the water committee.

Kansas City, Kas.—An ordinance has been passed providing for the issue of bonds for enlarging, improving and extending the water works system.

Oceanside, Cal.—The question of issuing bonds for improvements to the municipal water works system is being considered.

Anniston, Ala.—A 20-yr. contract with the Anniston Water Supply Co. became effective, after the defeat of the municipal ownership proposition, and one of the provisions of that company is that the main shall be extended to the 5th ward.

Louisville, Ky.—The Louisville Water Co. has decided to clean the two big reservoirs in Crescent Hill, and bids will be asked at once.

Springfield, Mo.—A petition has been submitted to city council asking for an appropriation of $550,000 for the construction of a municipal water plant.

Harrisburg, Ill.—The Saline County Light & Water Co. has been incorporated to construct, acquire, lease, maintain, extend and operate water works, electricity, etc.

Roslyn, L. I.—The new plans and specifications completed by W. E. Sexton, engr., based on the lines laid down by the State Water Commission have been approved. R. Tubby, water comr.

Jersey City, N. J.—The question of installing a device for the treatment of the water supplied to this city with bleaching powder was argued before Vice-Chancellor Stevens, July 20.

Coffeyville, Kas.—Will vote, Aug. 2, on the question of issuing $75,000 bonds for supplying this city with sheet or ground water for domestic and manufacturing purposes and for laying water mains and extending the present system.

CONTRACTS TO BE LET.

Gadsden, Ala.—Bids are asked until Aug. 4 for constructing a water works plant. W. T. Murphey, mayor.

Salem, O.—Bids are asked until Aug. 2 for constructing a water basin. C. R. Baker, dr. B. P. S.

Philip, S. D.—Bids are asked until Aug. 8 for constructing a water works system. A. S. Anderson, cy. audt.

Bird Island, Minn.—Bids are asked until Aug. 2 for extending a 4-in. water main. J. F. Cernan, vil. recdr.

Orleans, Neb.—Bids are asked until Aug. 5 for constructing a water works system. J. C. Gay, cy. clk.

Cherokee, Ia.—Bids are asked until Aug. 2 for sinking a well at the pumping station. Wm. Shardlow, cy. clk.

Wilson, Kas.—Bids are asked until Aug. 2 for constructing a water works and electric light plant. N. Coover, cy. clk.

White Hall, Ill.—Bids are asked until Aug. 5 for constructing a pumping station. Francis Fowler, mayor.

Euclid, Pa.—Sealed bids are asked until Aug. 22 for constructing a water main in Lawnview ave. Nelson J. Brewer, vil. clk.

Bridgeport, Okla.—Bids are asked until Aug. 15 for extending the water system and building a new power house. Cy. clk.

Edgemont, S. D.—Bids are asked until Aug. 10 for boring and piping an artesian well 2900 ft. deep. C. A. Hardy, cy. audt.

Washington, D. C.—Bids are asked until Aug. 15 for furnishing water meters and steel fillets. Gen'l purchasing agent, Isthmian Canal Comrs.

Keewatin, Minn.—Bids are asked until 8 p. m. Aug. 2 for 800 ft. of 6-in. river main, 2 hydrants and 2 cross ties. Geo. Oleson, vil. clk.

Attala, Ala.—Bids are asked until Aug. 4 for constructing a water works station, filters, machinery and extension of the system. Cy. coun.

Red Lake Falls, Minn.—Bids are asked until Aug. 5 for installing a pump, engine, air compressor, etc., in the court house. A. A. Latendresse, co. audt.

Cleveland Heights, O.—Bids are asked until Aug. 9 for constructing a 10-in. water main in Cedar road. H. H. Canfield, vil. clk., 307 Beckman Bldg., Cleveland.

Keeseville, N. Y.—Bids are asked until Aug. 25 for constructing 1 mi. of 10-in. c. i. water pipe, and a reservoir for a new source of water supply. J. B. Mace, prest, bd. water comrs.

Ft. Mason (San Francisco), Cal.—Bids are asked until Aug. 6 for constructing a reservoir, wooden tank, extending mains, etc., at Ft. Bang, Cal. Major Geo. McK. Williamson, Q. M., Ft. Mason.

CONTRACTS AWARDED.

Spooner, Wis.—Simpson & Stingle, of this city, secured the contract for the extension of the water mains.

Macomb, Ill.—The contract for constructing a water works plant has been awarded to the Pittsburg Filtration Co.

Colby, Kas.—The contract for constructing a water works system was awarded to F. C. Brooks & Son, of Jackson, Mich., for $55,000.

Grand Rapids, Mich.—Joseph Rusche was awarded a contract, July 7, for constructing a section of the filtration plant for $53,182.

Port Angeles, Wash.—The contract for supplying wooden pipe for the city water works system was awarded to W. W. Seymour of Tacoma.

Seattle, Wash.—The contract for constructing water mains in N. 73rd st. was awarded to the American Contracting Co., for $40,665.

Ft. Missoula, Mont.—The Des Moines Bridge & Iron Co., of Des Moines, was awarded a contract for a 3000-gal. field tank and trestle here, for $25,150.

Vale, Ore.—The American Light and Water Co., of Kansas City, Mo., has been awarded the contract for constructing a gravity water system, including auxiliary system.

Altus, Okla.—The contract for additional improvements to the city water works, light and sewer systems was awarded to the Maxcy Co., of Houston, Tex., for about $200,000.

Indianola, Ia.—The contract for laying 12,000 ft. of water mains, 15 Eddy hydrants and 17 Eddy gates, was awarded to the Des Moines Bridge & Iron Co., of Des Moines, for $7,000.

Montgomery, Ala.—The Hartley Boiler Works Co. was awarded the contract for building the river water standpipe for the new pumping station in North Montgomery, for about $10,000.

Atlantic City, N. J.—W. K. Mitchell & Co., of Philadelphia, was awarded a contract for installing steam and water pipes, valves and fittings at Absecon pumping station, for $7,450.

Philadelphia, Pa. — James Herbert Stitzer, Jr., 1201 Chestnut st., was awarded the contract for constructing a pump house, reservoir and storage tanks for the American Viscose Co., at Marous Hook.

Buffalo, N. Y.—Special.—A contract has been awarded to the Howard Iron Works for furnishing hydrants to this city for 1 yr., as follows: 6-in. hydrants, $47 each; 5-in., $44; 4-in., $41; 3-in., $32; 1½-in., $29.

Ft. Smith, Ark.—The Municipal Engineering and Construction Co., of Chattanooga, Tenn., submitted the lowest bid for laying water pipe and installing hydrants for the proposed water works extension. The cost will be about $75,000.

San Francisco, Cal.—The Keystone Construction Co., 18th and Clapp sts., was awarded a contract, July 6, for laying 17 mis. of pipe for the auxiliary salt water fire protective system in the district north of Market and east of Powell sts., for $129,000.

Andover, N. H.—Contracts for constructing water works were awarded, July 2, as follows: For pipe, to U. S. Cast Iron Pipe & Foundry Co., 71 Broadway, New York, at $24.70 per ton; hydrants and valves, to Fairbanks Co., $1,157, and pipe laying, etc., to Ablett & Bowes, Cohoes, N. Y.

BRIDGES.

Cleveland, O.—This city voted to issue $2,000,000 bonds to abolish grade crossings.

Carthage, Mo.—Bids are asked until Aug. 3 for building 6 county bridges. Wm. Kohlman, co. engr.

Danville, Ill.—Bids are asked until Aug. 2 for constructing 7 bridges. W. H. Nichols, co. audt.

Ft. Dodge, Ia.—Bids are asked until August 27 for constructing the 3rd st. viaduct. W. L. Tanke, cy. clk.

Laporte, Ind.—Bids are asked until Aug. 4 for constructing several bridges. Chas. Griswold, co. audt.

Martinsville, Ind.—Bids are asked until Aug. 2 for constructing 3 bridges. B. E. Thornburgh, co. audt.

Muncie, Ind.—Bids are asked until Aug. 3 for constructing 3 reinforced concrete arches. H. V. Moore, co. engr.

Paoli, Ind.—Bids are asked until Aug. 2 for constructing a bridge at Johnson's Ford. A. B. Ham. co. audt.

Wabash, Ind.—Bids are asked until Aug. 3 for constructing certain bridges. J. P. Noftzger, co. audt.

Brownstown, Ind.—Bids are asked until Aug. 2 for constructing 7 bridges. H. W. Wacker, co. audt.

Lima, O.—Bids are asked until Aug. 2 for constructing a bridge over Hog Creek. C. R. Phillips, co. clk.

Okwomah, Okla.—Bids are asked until Aug. 8 for constructing 25 steel and wooden bridges. E. Stine, cy. clk.

Sylvania, O.—Bids are asked until Aug. 2 for constructing a bridge. Chas. J. Sauzenbacher, co. audt.

Ft. Dodge, Ia.—Bids are asked until Aug. 22 for constructing a metal viaduct. S. J. Bennett, engr.

Brazil, Ind.—Bids are asked until Aug. 2 for constructing a steel bridge with concrete abutments. J. L. Burns, co. audt.

Fowler, Ind.—Bids are asked until Aug. 8 for constructing a bridge over Mud Pine Creek at Chase. Lemuel Shipman, co. audt.

Corydon, Ind.—Bids are asked until Aug. 2 for the repair of a bridge over Big Indian Creek. Wm. Taylor, co. audt.

Cleveland, O.—Bids are asked until Aug. 10 for constructing bridge work. John F. Goldenbogen, clk. co. comrs.

Sandusky, O.—Bids are asked until Aug. 10 for constructing a highway bascule bridge and approaches in Huron. John Dast, co. audt.

Gaffney, S. C.—Bids are asked until Sept. 5 for rebuilding steel approaches on concrete base, repair bridge, etc. E. Felix, co. supr.

Bridgeton, N. J.—Bids are asked until 2 p. m. Aug. 2 for building an arch bridge over Burnt Mill Stream; 10-ft.

addition to bridge at Black Water Stream. Walter M. Sharp, co. engr.

Oswego, N. Y.—Bids are asked until Aug. 2 for constructing a joint city and county bridge over the river at Bridge st. John Smith, comr. pub. wks.

Anderson, Ind.—Bids are asked until Aug. 16 for constructing 5 reinforced concrete and steel bridges near this city. A. Smith, co. engr.

New Castle, Ind.—The county council has appropriated $1250 for the construction of a bridge over Flat Rock, and bids will be asked soon.

Champlain, N. Y.—Bids are asked until 2 p. m. Aug. 3 for constructing abutments for the Cooperville highway bridge. Wm. Broder, town clk.

Shelbyville, Ind.—Bids are asked until Aug. 3 for constructing a bridge on Hancock-Shelby county line. G. B. Huntington, co. audt., Shelby co.

Des Moines, Ia.—Bids are asked until Aug. 10 for constructing 6 reinforced concrete bridges across Des Moines river at Walnut st. Mayor Hanna.

Wilmington, N. C.—Bids are asked until Aug. 16 for constructing a superstructure of a steel highway bridge over the railroad tracks at 6th st. C. R. Humphreys, cy. engr.

Ottawa, Ont.—Bids are asked until Sept. 1 for constructing the superstructure of a bridge across the St. Lawrence river, near Quebec. L. K. Jones, secy. dept. rys. & canals.

STREET LIGHTING.

Pueblo, Cal.—Voted to issue bonds for installing an electric light and power plant.

Cleveland, Tenn.—An electric light franchise has been granted to the Union Improvement Co.

Greenville, S. C.—The Home Lighting Co. has been granted a 30-yr. franchise for electric lighting.

Pocahontas, Ia.—Bids will be asked soon for constructing an electric plant. Geo. Schneider, cy. clk.

Wilson, Kas.—Bids are asked until Aug. 2 for constructing an electric light and water plant. N. Coover, cy. clk.

Hudson, O.—Plans for constructing a municipal electric light plant have been prepared and contracts will be let soon.

Ft. Morgan, Ala.—A contract for installing an electric light system here was awarded to the Babcock & Wilcox Co. of New Orleans, for $6994.

Muncie, Ind.—The Redkey Electric Co. has been incorporated to manufacture and sell electric current, by D. E. Breed, H. L. Finley and G. B. Ball.

Evergreen Park, Ill.—Bids are asked until Aug. 6 for constructing and installing poles, wires and globes for about 22 lamps. L. H. Weber, vil. clk.

Taylor, Tex.—A franchise has been granted to E. R. Schultz, of Alamagorda, N. Mex., for laying pipe and installing a plant for a gas plant.

Cleveland, O.—Bids are asked until Aug. 24 for electric current for lighting and power, and steam for heating. John F. Goldenbogen, clk. co. comrs.

Paullina, Ia.—The contract for constructing a municipal electric light plant was awarded to the Interstate Supply Co., of Sioux City, Ia., for $11,500.

Atlanta, Ga.—The citizens are considering the installation of a permanent ornamental electric lighting system for the main streets of this city. Forrest Adair is interested.

Boston, Mass.—Bids are asked until Aug. 4 for metallic filament lamps, as follows: 5435 25-watt, clear; 202 40-watt, frosted; 50 60-watt, frosted; 3 100-watt, frosted. Wm. J. Porter, audt. school com.

Crawfordsville, Ind. — Contracts for equipment for the new electric light plant have been awarded as follows: Generators and exciters, Ft. Wayne Electric Co., $21,715; 200 arc lamps, Westinghouse Electric Mfg. Co., $11,300.

Buffalo, N. Y.—Special.—This city contemplates installing 2 steam turbine generators of 5000 kw. capacity for the purpose of generating electric current to supply the requirements of the city in its different buildings and streets.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Natchez, Miss.—Bids are asked until Aug. 3 for sprinkling streets. W. G. Benbrook, mayor.

Butte, Mont.—This city contemplates erecting an incinerator at a cost of $50,000.

Washington, D. C.—It is probable that oil may be substituted for water in sprinkling the roads of the district.

Kansas City, Mo.—W. C. Weaver, supt. street cleaning, submitted a proposition to the board of public works, July 23, to purchase 2 motor trucks to replace the 16 horse carts that now follow the street sweepers.

PARKS.

20 acres is contemplated on the west side.

Fall River, Mass.—The board of aldermen have adopted a park loan of $50,000.

Grand Rapids, Mich.—This city is being urged by the citizens to issue bonds for acquiring new parks.

FIRE APPARATUS.

Beach, N. D.—This city has decided to purchase 2 chemical engines.

Appleton, Wis.—The purchase of a fire engine is contemplated. Mayor Canavan.

Baltimore, Md.—The purchase of an automobile fire engine is contemplated for the Alert Volunteer Fire Co.

Santa Barbara, Cal.—Bids are asked until Aug. 9 for a motor propelled combination chemical and hose wagon. Alfred Davis, clk. bd. fire comrs.

Louisville, Ky.—The Commercial Club of Jeffersontown will secure a modern fire department and fire apparatus.

New Orleans, La.—Plans for a new engine house at Carrollton ave. and Mess st. have been completed and when built, a hook and ladder truck and chemical engine will be installed.

Buffalo, N. Y.—Special.—The common council has ordered the construction of a fire engine house to be located at Amherst and East sts.; engine house at Clinton st. and Bailey ave.; fire truck house at Amherst and Grant sts. The commissioner of public works will prepare plans and get bids.

Municipal Engineering

VOLUME XXXIX SEPTEMBER, NINETEEN HUNDRED TEN NUMBER THREE

The International Good Roads Congress

By Clarence A. Kenyon, Indianapolis, Ind.

I WAS accredited by Governor Marshall of Indiana as a delegate to attend the "Second International Good Roads Congress" (the first having been held in Paris in 1908) to be held in Brussels from July 31 to August 10, 1910. To this duty I gave my best attention and am sending this necessarily short report of the Congress and my impressions for the benefit of such as may be interested.

As a preliminary word, I perhaps should say that the question of good roads is overwhelming in every country, except the United States; this will appear from the fact that when the permanent International Congress of Roads was formed two years ago, by the Union of various interested countries as members, each country to contribute to the expense and to be represented on the permanent board by one representative for each $200.00 contributed (no country to have in excess of 15 members) the United States did not join. Most of the European countries, Japan, and many of the South and Central American Republics, have made the appropriation and become members, the expense being from two hundred to three thousand dollars, according to the importance of the nation represented. But poor old United States has not become a member, although we are hopeful for the future. The five delegates appointed by the General Government and those delegates appointed by the Governors of various States were invited, and accepted as delegates by courtesy.

In spite of these embarrassments it was a great Congress. Think of 26 nations being represented by over two thousand delegates, mostly eminent civil engineers and road builders or administrators, all working and studying the question of how best to solve the great question of how to get good roads and how to keep them good under increasing and varying traffic conditions.

All of the papers presented by experts, as well as the conclusions of the last Congress, were digested by a corps of experts and formulated into nine "questions" and sub-questions; and these "questions" submitted to the Congress for discussion, amendment or rejection. The large numbers of delegates were divided into sections and sub-sections, and the various questions were submitted to each section, one speaking, say in French, another in English, another in German. If there was any disagreement, the three sections or sub-sections met together, and by the aid of interpreters, each speech being produced in the three languages, the discussion proceeded to a final conclusion. Where there was a diversity of opinion these discussions became animated and at times very interesting. As an example, the "question" under discussion condemned the macadam and gravel pavements and roadways, except for very light travel, and more or less by inference included mixtures of broken stone and gravel with tar, pitch and other bituminous substances.

The English delegates, comprising a corps of great engineers, as well as the American delegates, opposed this. In England as great and even greater advances are being made with tar and asphalt mixtures as are being made in the United States, and the English engineers are looking forward to this form of construction as the hope of the future, to preserve and protect their highways from the destructive effects of the ever increasing automobile traffic, at a cost that is within the reach of the tax payers.

The debate lasted, in section and sub-section, for two days and part of a third. The Continental delegates finally gave way on the latter part of the question and it was amended accordingly.

After all of the "questions" had been debated, amended, rejected or agreed

to, a grand final meeting was held, every delegate in full dress (as they were required to be at all formal meetings) and each question and sub-question was formally adopted.

To attempt to give these questions in a short report like this is not practicable, but I may give a few ideas taken from the questions and debates that may be valuable:

1. In the construction of roads and streets, good drainage, first class material and construction should not be sacrificed to mere cheapness, as they are most important in the years of upkeep to follow. The universal demand that everyone constantly repeats here is "conserve and maintain." It is regarded as a crime to spend the people's money to build roads and then fail to provide adequately for their upkeep. Nearly everyone I talked with could not understand the indifference of our people to good roads and especially to their upkeep. They cannot understand why we keep the obsolete system of "working out the road tax"; why loads of stone or gravel are dumped in the center of roads and such act called a repair; why the control of the roads and their upkeep is in the hands of county commissioners and township road supervisors; and that there are ninety-two sets of such officials in Indiana alone without any central control. In France this central control is regarded as of so much importance to the country that the roads and bridges are under a cabinet officer of the Nation, the Prefect of the Seine. In England they are under the charge of the General Governing Board at the head of which is an English nobleman who is proud to serve. An Englishman said to me: "I should think your people and especially your newspapers that exert such great power, would rise up against such obsolete methods." I told him it seemed hard to get them interested. He said that "good roads and their upkeep were more important than prize fights, and that the newspapers were interested in them."

2. The roads and their upkeep should be in the hands of some Central Bureau or Commission, like a Highway Commission, and the State should aid in the construction and maintenance of roads; uniform specifications and repairs are thus permitted.

3. The wood pavement was given the highest character where well constructed, not only in being quiet but in resisting heavy traffic.

4. Stone pavement is best for heavy traffic, where noise and comfort is of no consideration, as the cost of upkeep is the lowest;

5. Bituminous pavements, for moderate traffic where smooth surface and quiet is desired,

6. And most admirable for heavy country roads, etc.

7. Brick pavements were not mentioned, unless under the category of stone block pavements. There are none in London, Paris, Vienna or Berlin; only a few in Brussels, Amsterdam and Rotterdam; quite a few in the Hague, but even the Dutch engineers did not contend for them. It was quite a surprise to me.

8. Heavy flushing of streets with water was condemned; light sprinkling commended. Early morning cleaning and done quickly was urged.

9. Mechanical processes were particularly recommended.

10. Motor machines were recommended for cleaning and sprinkling in large cities.

11. A good deal of attention was given to stret railway tracks, urging puting them to the side of the street or road where possible and insistence on the tracks and pavement alongside being kept in good repair. There is no quibbling about this question in Europe; it is done.

12. Where electric lines are permitted to use the highways, they should be required to pave and keep the pavement in repair or have a separate space for the track above and at the side of the road.

13. Motor omnibuses were commended under proper regulation and the hope expressed that the service will be extended with lighter cars to the rural districts. Motor trucks on roads were regarded as a convenience and necessity and local communities were advised to test their bridges where the trucks are being used. It was recomended that their speed be not to exceed 25 kilometres (16 miles) per hour and that large and wide tires be used (sizes given). No ribbed or grooved tires should be permitted; no tree should be cut down where it can be avoided.

This will give a general idea of the subjects discussed and in a general way, the conclusions.

It seems that in America we are not alone in ultra- individualism. In other countries as well it seems that as soon as some engineers and officials come into office they become immediately self-sufficient, their ideas of engineering, of construction, of main-

tenance, are at once the best; things previous engineers and officials have done are bad, even the law must be changed to meet their ideas in many instances. It was urged by many delegates that the overwhelming authority of the eminent engineers and constructors of the civilized world might to some extent hold this aggressive quality in public officials in check in the interest of the tax payer, and besides, to the right-thinking official the conclusions expressed by such a Congress will be in the nature of standards that should not be departed from without just cause.

I need not dwell on the hospitable way in which the King, the Government of Belgium and the city of Brussels treated the delegates. A reception attended by the King and suite, several excursions and a banquet were among the entertainments.

The American Minister, Mr. Charles F. Bryan, gave an elegant dinner to the American delegates at his residence, which was much appreciated and enjoyed.

The Municipal Electric Lighting Plant at Richmond, Ind.

IN 1898, the dissatisfaction of the citizens of Richmond, Ind., with their existing electric lighting conditions, found expression in the the fact that municipal ownership was made the issue of a mayoralty election. The Richmond Light, Heat and Power Company furnished both gas and electric lights for the city and from various reasons seemed to favor gas as an illuminant. Their contract with the city for street lighting provided for not less than 150 arc lights at $90 apiece per year; and their rates to private consumers were 15 cents per kw. with no discount.

In 1901 bonds were voted and the plans of the municipal lighting plant were completed. The following spring the plant was completed and stood ready for operation with no customers and restrained from furnishing the city street lights by the fact that the private concern had a contract extending until 1904. The management of the plant was under control of the city council until the fall of 1902 when a commission of three was appointed to take charge. This commission operated the plant until 1905 when the state law provided for the control being held by the Board of Public Works, consisting of the mayor, the president of the board and the city engineer; making the control of the plant virtually in the hands of the mayor.

The cost of the plant complete in 1902 was $158,582, of which $144,000 was provided for by 4 per cent. bonds, payable in 1927, and the balance was advanced by the city. This cost was further increased each year by additional wiring, meters, etc., and in 1907 a new unit was added to provide for the increasing business. The first few years showed a loss due to the fact that the city was held to its lighting contract with the private concern and to the fact that additional equipment kept in advance of the receipts. Finally at the termination of the city's contract with the L., H. & P. Co., the municipal plant undertook the street lighting at a rate of $75.00 per arc, a decrease of $15.00 per year from the former rate. The rates for private consumers have been kept constant throughout and are as follows:

—Light Rates—

From 1 to 50 kw.....	9	Cents
" 51 to 200 kw.....	8	"
" 201 to 1,000 kw.....	7	"
" 1,001 and over.....	6	"

—Power Rates—

From 1 to 200 kw.....	6	Cents
" 201 to 1,000 kw.....	5	"
" 1,001 to 3,000 kw.....	4	"
" 3,001 to 5,000 kw.....	3	"
" 5,000 or more kw.....	2½	"

with a 20 per cent. discount for payment before the 10th of each month and a 50-cent minimum charge. No meter rent, nor deposit, nor charge for outside wiring is made. The city's 307 arc lights are now furnished at a cost of $43.85 apiece to the municipal lighting plant; while in the summer 47 additional lights are furnished for park use. The street arcs are operated all night throughout the year with no "moonlight" schedule.

The competition between the municipal plant and the Light, Heat and Power Company has been very keen. The L. H. & P. Co. tried by cutting their prices to meet the city's compe-

tition for private business, but the city refused to meet any such cuts. Of course some customers were lost by the procedure, but on the other hand many, through loyalty to the city, came voluntarily to the support of its plant. In 1907 the L., H. & P. Co. employed experts to investigate the books of the municipal plant and endeavored to prove to the citizens that the municipal ownership was a losing proposition. This investigation was followed by repeated efforts to buy the plant, but as the experts had failed to show a loss, the offers were refused. Even at the present time each prospective customer is solicited by representatives from both plants and each extension of service is hotly contested.

As will be seen from this table, the depreciation, on a 10 per cent. basis, is more than taken care of by the income from the street and public lighting taken year by year, though the total depreciation more than equals the income from such lighting up to the present time, owing to the three years when the streets were lighted by the private company at a cost of $90 per arc per annum.

At the present time the money advanced by the city, excluding the $144,000 bond issue, has more than been offset by the net earnings and with the present net earnings capacity of between $30,000 and $40,000 per year, it would not take long to provide for retiring the bonds and to start a sinking fund towards the cost of re-

Year Previous to	Receipts	Operating Expenses	Construction and Equipment	Receipts from Street and Park Lights	Advanced by the City	Paid to City	Depreciation
1902 ..	.....	.....	.....	.....	$158,582.29	.....	.....
1902 ..	$ 6,812.89	$11,472.80	$15,142.14	.....	21,341.05	.....	$ 15,858.22
1903 ..	28,997.91	30,360.67	17,615.22	.....	18,838.01	.....	15,786.62
1904 ..	38,064.10	30,415.26	18,498.44	.....	14,117.69	.....	15,969.48
1905 ..	56,257.78	31,330.41	12,739.80	$ 22,479.11	6,291.48	$18,887.57	16,222.37
1906 ..	63,188.78	33,587.03	12,959.18	22,659.94	.....	9,506.94	15,874.12
1907 ..	72,956.94	44,928.77	34,832.57	22,958.84	6,804.40	.....	15,582.62
1908 ..	75,694.64	44,022.33	12,069.74	23,171.04	.....	19,602.91	17,507.62
1909 ..	88,488.95	42,967.44	10,493.72	23,814.38	.....	35,027.79	16,963.79
				$115,083.31	$225,974.92	$83,025.21	$129,764.84

Advanced by the city...	225,974.92		
Less bonded indebtedness	144,000.00		
	$1,974.22	Depreciation	$129,764.84
Net earnings	$83,025.21	Income from Public Lighting	115,083.31
.. Net profit	$ 1,050.29		$ 14,681.53

REMARKS:—Previous to 1902 includes $144,000 of 4 per cent. bonds; 1902, no income from city lighting; 1906, $7,135.63 paid on permanent improvement; 1907, $22,931.15 paid on new power unit.

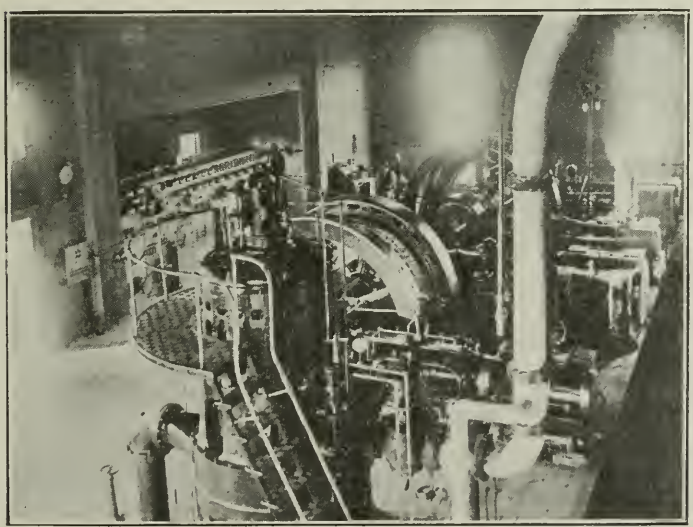
The progress of the municipal plant can perhaps best be shown by the above table computed from the reports of the superintendent. Column 2 of the table shows the gross receipts for each year; column 3 includes all operating expenses, salaries, coal, oil, repairs, bond interest and commission and miscellaneous; column 4 includes wire, poles, meters, transformers, new additions and extensions and sundry equipment; column 5 shows the amount paid by the city for street, park and public building lighting (Note: Previous to 1905 the private company furnished these lights, and during the present year, 1910, the lights are furnished free of charge to the city); column 6 includes all money advanced by the city on the lighting plant and equipment; column 7 shows the amounts repaid to the city by the lighting plant; and column 7 shows the depreciation costs figured at 10 per cent. of the cost of the plant with the addition of the new construction charge and less the depreciation charge for preceding year. producing the plant at the time such reproduction becomes necessary. It is not impossible, however, as the plant is entirely a municipal utility, that the consumers will insist upon a reduction of rates and thus reduce the earnings.

It will be noticed that the receipts of the company have shown a steady advance from the start. The monthly reports up to and including July of this year show a balance of over $19,000 in excess of the expenses, and the report for the month of June, which is usually the lightest month in the year, shows an excess of receipts over operating expenses of $4,792.40.

The last invoice gave the value of the plant and line equipment at $300,000, and it is the intention to add to this in 1911.

The power plant at present has three main generating units. The generating equipment consists of: one Curtis steam turbine, operating at 1,-

I. MUNICIPAL ELECTRIC LIGHTING PLANT AT RICHMOND, IND.



II. ENGINE ROOM OF MUNICIPAL ELECTRIC LIGHT PLANT, RICHMOND, IND.

000 r. p. m.; a 500 kw. a. c. generator; one 650 h. p. cross compound Alfree engine directly connected to a 450-kw. a. c. generator; and one 450-h.p. cross compound Alfree engine directly connected to a 300-kw. a. c. generator. Both of the latter units operate at 150 r. p. m., and the three units are arranged to run singly or in muitiple. For exciting the fields of the generators there are two 15-kw. d. c. generators direct connected to a 7x8-inch center crank Alfree engine running at 400 r. p. m. In addition to the machines there are one 100-kw. rotary converter and one 37.5-kw. rotary converter, besides condensers and feed-water pumps.

The switchboard equipment consists of 3 generator panels, 1 exciter panel, 3 feeder panels (with 2 lines per panel), 2 arc panels and 4 converter panels (2 a. c. and 2 d. c.). The whole switchboard equipment as well as the generator layout was manufactured by the General Electric Company.

The boiler room has 4 Sterling water tube boilers equipped with Roney stokers and the total power output is 1,240 h. p. The plant is taken care of and operated by 1 chief engineer, 3 engineers, 3 firemen, 1 brakeman, 1 laborer and 1 oiler. The total coal consumption is 8,000 tons per year of West Virginia coal; and the total output of the plant last year was 2,646,-670 kw. The accompanying photographs show the power plant and its generative equipment.

Everyone connected with the plant in any capacity is proud of its success and seems to feel a personal interest in its welfare. To this fact and to the principle of keeping the control of the plant and the employment of its men free from politics may be ascribed the success which it has achieved.

The Mill Creek Intercepting Sewer at Erie, Pa.

THE accompanying photographs show various stages in the construction of retaining walls and intercepting sewers along the banks of Mill Creek in Erie, Pa., in Section 1 of the work of improvement. This creek runs through the city from north to south, discharging into Erie harbor, Presqu' Isle Bay, near its mouth. It has a heavy fall down the slope of the hill and has cut down to the solid rock throughout.

The retaining wall is built on the solid rock, and the sewer is built in combination with it, as shown, so that where the grade of the sewer demands it the rock is excavated down to the sewer line. The flow line of the sewer is approximately parallel to the flow line of the creek, but occasionally an excavation of 6 feet or more below the bed of the creek was necessary to give approximate uniformity to the grade line of the sewer. The sudden and heavy floods in the creek made the rock excavation and the construction of the wall and sewer hazardous and rather expensive.

The wall in Section 1 as shown is about 10 feet high, 5.5 feet in width and 1600 feet long. The sewer shown in most of the photographs is 36 inches in diameter. The streets cross the creek on bridges some 25 feet above the intercepting sewer, so that all the sewers which have heretofore discharged directly into Mill Creek will now be intercepted and the ordinary flow of sewage will be carried off by the intercepting sewers on both sides of the creek, only excess of storm water escaping into the creek.

The second section of the work is 1200 feet of 36-inch vitrified pipe sewer in a cut averaging 17 feet in earth and rock.

A third section has 1220 feet of 24-inch vitrified pipe; the fourth section 2300 feet of 24, 20, 18 and 15-inch pipe; the fifth section 2300 feet of 12-inch pipe; the sixth section 5160 feet of 12-inch vitrified pipe. The total estimated cost of the sewer, 14065 feet long, is $38300. The wall is paid for at the rate of $5.50 a cubic yard of concrete, allowance being made for the space occupied by the sewer, and as it varies much in height, its cost can scarcely be ascertained until the work is all completed.

We are indebted to the Indianapolis office of the Lehigh Portland Cement Company for the photographs accompanying.

RETAINING WALLS AND INTERCEPTING SEWERS ALONG MILL CREEK, ERIE, PA.

RETAINING WALLS AND INTERCEPTING SEWERS ALONG MILL CREEK, ERIE, PA.

Bituminous Roads, Mixed and Poured*

By George C. Warren, President of Warren Brothers Company, Boston, Mass.

IN the year 1909 the New York Herald and Atlanta (Ga.) Journal offered premiums of $1,000 for the first; $500 for the second, and $250 for the third best section of country road between New York City and Atlanta, Georgia, one of the southern of the United States of America, covering a distance by air line of about 750 miles.

The first premium was awarded to Mercer county in the State of New Jersey, of which Frank I. Eppele is county engineer.

In an excellent paper on the subject of "Future Highway Improvement," published in a current paving journal, Mr. Eppele says:

"I think the statement can be made that already the problem has been solved in part and that road engineers have practically agreed that the principles of construction which provide for the broken stone or other road metal used to sustain the wear, and some bituminous product applied in conjunction with same, possessing in a high degree the necessary binding and dust preventive qualities, will be the basis for adoption of a method for future highway construction. If this be true, I think we can logically conclude that a majority of road engineers will favor a method of construction that insures a perfect coating of bituminous binder to every particle of road metal being used, and before same is spread upon the highway, to one that provides for the application of a binder to the surface of the material after same has been spread upon the work either by a method of pouring, sprinkling or spraying and then depending upon the penetration qualities of the binder to give a uniform and perfect condition of coated work. Were it not for the question of cost involved I am sure that a form of construction involving the use of a mechanically coated material, for at least the top course, or wearing surface of a road, would be adopted; but even taking into consideration this question of first cost, would not this increase be more than balanced by the condition of the roadway together with the wearing and other improved qualities of the same after construction?"

From an article in the same publication we extract the following:

"It is safe to say that a grouted road is not as satisfactory and long-lived as a mixed road. As the desirability of accurate proportions in a bituminous macadam is great the batch mixer will probably prove most satisfactory. The best results in Massachusetts have been obtained with broken trap rock 2½ inch to ½ inch in size, having 40 per cent. or less voids. If this percentage of voids is lessened by more small particles in the aggregate, say from 2½ inch to ¼ inch, still better results obtain. I believe that when a softer rock is used the slight crush which takes place during the construction draws in more bitumen and produces a denser pavement. Experiments have shown that bituminous surfaces having the voids filled with bitumen and trap pea-stone are to be preferred in every case.

"A mixture of 2½-in. to ½-in. trap stone with 40 per cent. ½-in. sand well mixed dry, and then coated with bitumen should prove to be a very permanent road matrix."

The question naturally arises: If a mineral aggregate varying from 2½-in. to ½-in., having 40 per cent. or less voids, is good, and if running the fineness of the stone down to ¼ inch is better, and if the voids are filled with sand, the mixture is still better, why should not the "ne plus ultra" be provided by going a little farther in the scaling down process as to sizes and using scientifically determined and accurately proportioned mineral aggregate down to the finest obtainable (impalpable powder) in which mixture the voids can be reduced as low as 10 per cent. and all the voids thoroughly filled?

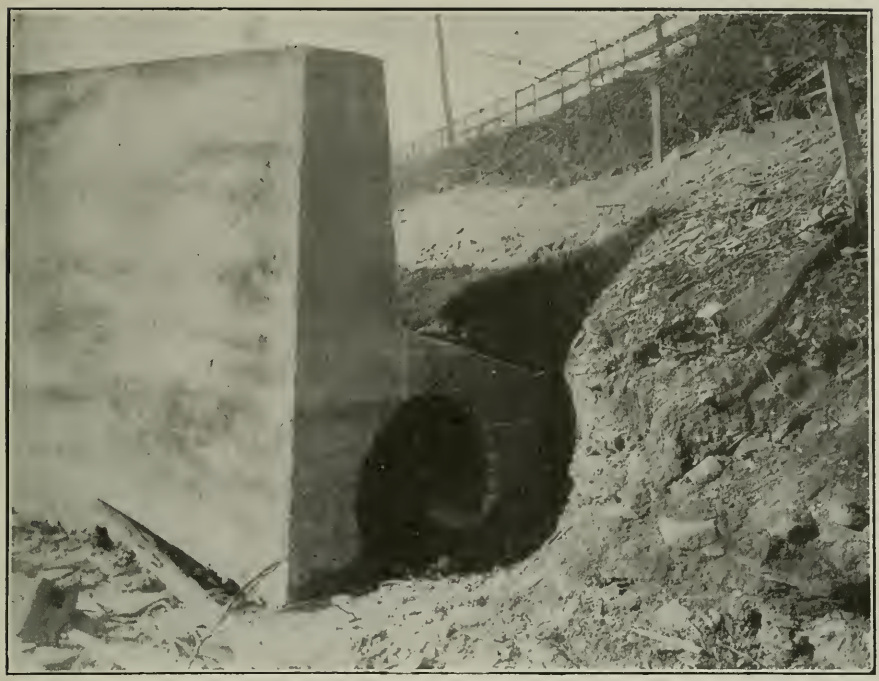
Turning to the subject of this paper, pouring or penetration methods have the following advantages:

a. Very little investment in plant.

b. The cheapest possible method of application.

The following are the disadvantages of the pouring methods:

*Written by request for presentation at the International Road Congress Brussels. Belgium.



RETAINING WALLS AND INTERCEPTING SEWERS ALONG MILL CREEK, ERIE, PA.

RETAINING WALLS AND INTERCEPTING SEWERS ALONG MILL CREEK, ERIE, PA.

a. After the stone is rolled the portions of the surfaces of many of the individual stones are in such contact with each other and many of the voids are so small that the bitumen cannot penetrate into many of the spaces, and consequently cannot thoroughly coat the particles of stone. This objection rapidly increases as the minimum size of the stone used and the voids decrease.

b. If the bitumen used is not hard enough and of a character sufficiently cementitious to bind the particles of stone together the road will gradually ravel if subjected to even a moderate traffic.

c. Unless enough bitumen is used to thoroughly fill the voids to the greatest extent practicable, the particles of aggregate are not even approximately bound together and satisfaction is only temporary.

d. If the voids are filled with bitumen as much as practicable, then the roadway has a surplus of bitumen, or rather it is not properly distributed through the mass, and the free and nearly pure bitumen in the large voids oozes to the surface under traffic during hot weather, making a sticky, unstable, and undesirable surface, which ruts and rolls badly under traffic.

Very good examples of the two last mentioned disadvantages and inherent weakness of construction are found on sections of Huntington avenue in Boston, Mass., which were laid under the most approved penetration methods during the summer of 1909. From the east side of Gainsboro street to the east side of Bryant street the spaces between the stones were filled very full with bituminous binder. To facilitate and make more thorough the filling of the voids the precaution was taken, after rolling the stone, of heating it with a large gasoline flame confined under a sheet-iron hood resting on the surface of the rolled stone. The apparatus used being that known in the asphalt paving business as "surface repair heater." Between east side of Bryant street and east side of Ruggles street less bitumen was used and consequently there were voids less thoroughly filled. In both sections bituminous cements were used of a grade of hardness which required heating to a temperature of about 275 degrees F. to liquify, and consequently they were cementitious and of the true binder class as distinguished from liquid oils and tars often called binders, although in the writer's judgment more properly classed as dust layers. Both sections presented a fine appearance during the summer and fall of 1909, the spring of 1910 and the intervening winter, except that in spots in both sections where the bitumen had not penetrated well into the surface, raveling began in the early spring. On June 13, 1910, on the section in which the voids in the stone were least filled, the bitumen has disappeared from over one-third of the surface and we have on such portions practically a macadam road (as if no bitumen had been used) which is already raveling and promises at an early date to require entire resurfacing. This section of the street shows great irregularity in amount of bitumen used, as there are many places from 2 ft. to 10 ft. in length where there is an excess of bitumen, which has been pumped by traffic to the surface and now is much too rich, showing deep calk marks and an unstable surface. On the section where the greater quantity of bitumen was used the surface is now so very soft that automobile and other vehicle wheels and horses' hoofs press into the nearly pure bitumen and unstable mineral aggregate at the surface to a depth of over half an inch and the surface presents a very sticky and undesirable condition. In describing the rutting and marking of vehicle wheels and horses' hoofs, reference is made to moving horses and vehicles in the center of the roadway and not to the still greater marking from standing vehicles and horses near the gutter.

The mixing methods are of two general classes as to hardness of bitumen, known as cold process and hot process, and two classes as to method of mixing known as hand mixing and machine mixing, which will be treated in the order named.

The cold process means the use of a mixture of stone and bitumen of such a character that the ingredients can be mixed and laid without artificial heat, that is, at the temperature of the air. This necessitates the use of bitumen of a character which is liquid when cold and, as above referred to in connection with penetration methods, is necessarily deficient in cementing strength, unless the bitumen is made liquid by the use of a volatile temporary liquifier which will evaporate soon after the roadway surface is laid. The cold process is also necessarily subject to the weakness that the moisture has not been evaporated from the aggregate

before adding the bitumen, which seems to be bad practice to say the least.

In the writer's judgment, other things being equal, the hot process gives the best results, but is necessarily more expensive, on account of the more or less expensive plant required to heat and mix the ingredients, but also on account of the greater amount of labor required to heat and roll the much tougher, denser and harder surface mixture. The hot process has the great advantage of providing a surface which is set hard as soon as compressed and chilled to the temperature of the air.

Hand mixtures have the following advantages over machine mixtures:

a. Comparatively little expense of plant installation, on account of which it is applicable for use on roadways of less area than practicable by machine methods.

b. No cost of fuel and consequent saving.

c. Some writers say machine mixing labor is less than hand mixing, but taking all items of cost, including plant installation and delivery of materials to and from the mixing plant, and labor of mixing and laying into consideration, the writer believes as a rule the reverse is the real condition.

The disadvantages of the hand mixing processes are.

a. Manifestly less thorough mixing and less accurate proportioning and uniform distribution of ingredients and consequently greater variableness of results than with a properly constructed mixing and heating plant.

b. Because of greater ease in hand mixing a marked tendency toward use of a softer bitumen.

c. Impracticability of getting a thorough mixture without more power than can be executed by hand if the combination of ingredients is as dense as it should be to produce the best results.

Machine mixing methods may be subdivided into several classes as follows:

First. Mixing without accurately proportioning or heating ingredients for which ordinary concrete mixers either of the continuous or batch types will answer. This method has the advantage of least expense in plant and labor, which in the writer's judgment is very much more than counterbalanced by the disadvantages of using bitumen of a grade so soft as to be liquid at normal temperature and of less accuracy and uniformity of results.

Second. Mixing by heating without accurately proportioning the ingredients, which in the writer's judgment is better than the last named method but still inherently defective.

Third. Using a well planned mixing and heating machine specially constructed for the purpose, which will produce the following essentials to a miximum degree of success:

a. Uniformity and accuracy of proportioning of ingredients both as to varying sizes of mineral aggregate and amount of bitumen.

b. Sufficient heat in the ingredients when mixed and laid in the work to evaporate moisture and permit the use of bitumen hard enough to furnish a true binder.

c. When compressed in the work, a solid, dense, voidless, dry bituminous concrete wearing surface that will to the greatest possible extent prevent penetration of moisture (the enemy of all road surfaces) and withstand the troublesome automobile and other traffic without shifting or presenting undesirably soft surfaces.

A word here on the subject of proportioning of mineral aggregates in bituminous wearing surfaces may not be out of place. The writer believes from his wide experience and observation as well as from theoretical reasoning that the following are necessary essentials to the best construction.

First. That the sizes of stone or mixture of stone and sand composing the mineral aggregate of the wearing surface shall be scientifically and accurately proportioned varying from the coarsest size permitted by the thickness of the surface (at least one-half inch less than the depth of compressed surface desired) down to an impalpable powder, each size so proportioned as to reduce the voids to the greatest practicable extent, which in practical work can be as low as 10 to 15 per cent. of the volume. To practically produce this result a mixing plant designed to proportion and control the sizes of the aggregates is essential.

Second. That sufficient bitumen shall be used to thoroughly fill the remaining voids and evenly but thoroughly coat every particle of aggregate, large and small, with a thin coating of bituminous cement of a grade, which when cold provides a high degree of cementing strength, and solid construction of bituminous

concrete, which (as is practically possible) when thoroughly compressed on the road foundation, has the density and within about five per cent. of the specific gravity of solid rock of the character used in the wearing surface. This difference in specific gravity represents the difference between the specific gravity of the stone (say 2.8) and the bitumen (say 1.0-1.25) used in the construction, and not voids or lack of density or stability in the compressed bituminous concrete wearing surface.

Such a construction necessarily costs more than more or less makeshift substitutes, but in the writer's judgment, as a general proposition, the difference in cost is well expended and the cheaper processes will be found by practical experience to be the most expensive in the end. The writer believes that road surfaces made of mineral aggregate and bitumen are and will continue to be successes or failures in proportion as they accompiish or digress from these essentials to the best results.

These are basic principles embodied in the construction of the bitulithic pavement for city streets now in its tenth year of successful use.

Brick Highways in Ohio

THE success of Cuyahoga county in building brick roads during the past twelve or fourteen years has been so pronounced that the comparatively new State Highway Commission finds it possible to use brick on many of the roads which it builds. The cost of these state roads is divided between state and county according to methods prescribed in the law, which give ample opportunity for local option as to the amount and cost of work to be done. The results are of interest at this time.

In 1908 the contracts let by the state highway department included 7.17 miles of brick pavements, over 20 per cent. of the mileage of the year. In 1909 the mileage of brick pavement contracted for increased to 20.45 miles, which was nearly one-third of the mileage of the year. A similar progress is being made during the present year.

The state's brick pavements are ordinarily laid with concrete foundation and sand cushion costing about 88.2 cents a cubic yard, concrete curb costing about 25 cents a linear foot, brick surface costing about 80 cents a square yard, cement filler and tar expansion joints costing about 6 cents a square yard. Excavation costs 25 cents a cubic yard and gravel backing for the curbs costs 50 cents a cubic yard.

The accompanying photographs, for which we are indebted to James C. Wonders, State Highway Commissioner, show some of the recent work and methods used in construction.

The first photograph shows the East Avenue road in Goshen township, Tuscarawas county, which was let by contract for $17,137.12, and is 1.49 miles long, with roadbed 26 feet wide and brick surface 15 feet wide. The maximum grade was reduced from 3.7 to 1.1 per cent. The photograph shows the process of laying brick, which are delivered on a brick conveyor, thus saving manual labor, disturbance of the bricks after laying and time of the brick layers.

The second photograph shows the completed East Palestine road, Unity township, Columbiana county, except that the bermes have not yet been put in proper condition. This road has a gravel foundation and sand cushion costing about 20 cents a square yard. The contract price was $18,000 for 1.51 miles with roadbed 22 feet wide and brick surface 14 feet wide. The maximum grade of 6.5 per cent. was reduced to 4.1 per cent. by the improvement.

The third photograph shows a brick road on a gravel foundation, the Athens and Chauncey road, Athens and Dover townships, Athens county. The foundation and sand cushion cost about 25 cents a square yard and the brick surface about 64 cents. Sandstone curb was used. The road is 0.9 mile long, with roadbed 22 feet and brick surface 12 feet wide, and it cost $11,941.45. The maximum grade, of 10 per cent. before improvement, was reduced to 6 per cent.

The fourth photograph shows the Green Street road, Marietta township, Washington county, which is 1.14 miles long, has a roadbed 24 feet wide and brick surface 16 feet wide. The contract price for this road was $15,490. Part of the concrete curb on this road was flush with the brick and part was raised. The latter cost a trifle more

1. OHIO STATE HIGHWAYS.
Brick Pavement on East Avenue Road. Tuscarawas County.

than the former. The maximum grade of 8.5 per cent. was reduced to 5 per cent. The photograph shows the concrete curbs completed and forms removed, some of the form boards lying in the foreground. The brick are piled along the curb to be laid as soon as the foundation is completed.

It will be noted that these roads differ in some respects from the later Cuyahoga county roads in that they have a crown in the center, instead of plane surfaces sloping from one curb to the other; and that they are laid approximately in the center of the roadbed, instead of giving all the space for vehicle traffic on the unpaved portion of the roadbed on one side of the pavement.

The Municipal Water Works of Mattoon, Ill.

MATTOON, a town of 15,000 population, was in 1905 brought to face a question which not only concerned the welfare of the city, but in fact placed at stake its whole industrial future. The shops of the Big Four railroad company are located at Mattoon and, though not the sole employer of labor, these shops were the largest single factor in the labor employment field. At this time some improvements in the shops were contemplated and the Big Four refused to go ahead with these improvements and in fact threatened to move their shops unless the city would guarantee them all the water they wished to use. Previous to this time the Mattoon Clear Water Company was furnishing water from subterranean wells and their capacity was only 1,000,000 gallons per day during their best season of the year, while at times their supply was as low as 500,000 gallons per day. The total quantity of water needed for the Big Four and other commercial lines was 1,500,000 gallons per day.

After a consideration of the question in all its phases and weighing carefully all the solutions of the problem, a system was decided on and built, consisting of an impounding reservoir and a service reservoir with the necessary pumping equipment. The impounding reservoir is situated about five miles from town and was constructed by building an earth dam with a concrete spillway and a 4-foot concrete core wall, across a stream draining a large area of farm land. The reservoir has a capacity of 200,000,000 gallons. At the upper end of the reservoir, about one mile from the dam, a pumping station was built. The equipment of this station consists of two 1,000,000-gallon per day pumps of the duplex compound type, manufactured by Fairbanks, Morse & Co.

From this station the water is pumped through a 12-inch cast iron main to the summit of a hill about two and one-half miles from the station. From here gravity flow carries the water through an 18-inch vitrified pipe to the receiving reservoir. The vitrified pipe was laid with tightly sealed cement joints. At points along the line of vitrified pipe, farm drains are connected and add their flow to that from the reservoir.

The service reservoir is built of waterproofed concrete and has a capacity of 1,500,000 gallons or one day's supply at the present rate of consumption. The equipment of the pumping station at this point consists of two 1,000,000-gallon high-duty pumps of the same manufacture as those at the impounding reservoir.

At present the water from this system is fit only for commercial purposes, but a filter system could readily be installed.

At the present time about 750,000 gallons per day is pumped from the service reservoir, and of this amount the Big Four uses 500,000 gallons and the Illinois Central uses 100,000 gallons. The monthly income from consumers is about $1100.

The water is said to be of excellent properties for boiler use. Following is an analysis of its chemical properties stated in parts per million:

Alkalinity (as $CaCO_3$)	203
Chlorine	8
Magnesium (as $CaCO_3$)	113
Incrustants (as $CaCO_3$)	54
Total Solids	298
Free Carbonic Acid (CO_2)	12

The costs of constructing the system were brought down to a minimum by the use of labor-saving devices throughout. Wheel scrapers were used to carry the clay material for the selected fill of the dam from a distance of about 1000 feet. Slips were used to convey the ordinary earth fill from the lower

2. OHIO STATE HIGHWAYS.
Brick Pavement on East Palestine Road, Columbiana County.

side of the dam. The concrete for the spillway was machine mixed on a platform over the forms and was dropped into wheelbarrows and wheeled into place. The trenching was done with a Chicago trenching machine and slips were used in backfilling. The cost of the plant at present is given as follows:

Land	$18,583.42
Dam and reservoir	38,803.69
Buildings	5,221.75
Machinery	10,975.65
Pipe lines and conduits	42,950.91
Total	$116,535.42

M. C. L. Jones, city engineer of Mattoon, superintended the construction of the system. Prof. A. N. Talbot was consulting engineer.

A description of the plant of the Mattoon Clear Water Company, which furnishes the domestic water supply for the city, will be found in MUNICIPAL ENGINEERING, vol. xxxviii, p. 402.

London and Glasgow Main Drainage

By a Special Correspondent

THE steady increase in the population of London and the continual requests from outlying districts to discharge sewage into the main sewers made it clear some years since that it would be necessary to extend the scheme of intercepting sewers formulated by Sir Joseph Bazalgette forty years ago, and in 1899 the London county council decided to construct a considerable number of additional sewers.

The extension works which have been completed or are now being carried out, include, on the north side of the Thames, two new outfall sewers, each 9 ft. by 9 ft., which are now in use, as well as the three previously existing lines of similar sewers: a new "Middle Level" sewer from Willesden to Old Ford some 9 miles in length, which is also in use; and a sewer known as the "Northern Low Level No. 2," which extends from Hammersmith to the Abbey Mills pumping station at Stratford, a distance of nearly 13 miles, of which parts are now under construction. In view of the large additional quantities of sewage and storm water which, when completed, the last sewer will deliver at Abbey Mills pumping station, and because the existing pumping plant at Abbey Mills is already severely taxed during storms, it has decided to erect at this station, on ground adjacent to the existing engine houses, a new engine house with powerful pumping plant.

The water lifted by this new plant will be discharged either into the high-level outfall sewers already referred to or under the powers reserved to the council by its General Powers Act of 1909, into the branches of the River Lea.

The building work is now in progress. The pumping plant about to be erected in this new station will be generally similar to that in the council's other storm-water pumping stations. As in the case of those stations, the new plant will generally work during rainstorms only, and in consequence it will be operated from 60 or 70 hours up to, say 200 hours in each year, according to the number and magnitude of storms which may have to be dealt with.

As an indication of the enormous damage that may be done by flooding during a severe storm—damage which it is hoped to reduce very materially if not to obviate entirely, by means of these storm-water stations—it may be recalled that on July 23, 1903, no less than 2.97 inches and 3.59 of rain were recorded in the course of 24 hours at Deptford and Abbey Mills pumping stations respectively, and that, notwithstanding the extensive storm relief works then in existence, many places were flooded that had never before been so affected, and over 1,000 complaints were received from borough councils and private persons. It will therefore be apparent that these storm relief plants are required to deal with sudden emergencies, and that if they are to be of service it must be possible to get all the pumps into full operation in the course of a few minutes.

In the old station at the Isle of Dogs the motive power is steam, and in order that power may be always available at very short notice, the boiler fires are kept "banked" night and day,

Sundays and week-days; but in the more modern stations gas-engines have been provided so that the expense of maintaining "banked" fires may be avoided. The fuel employed is town's gas, as, although producer gas would be cheaper, the producers would also require to stand continually with "banked" fires. In view of the short periods during which the plants are at work, the extra cost of town's gas is negligible.

trifugal pumps driven from the main engine shafts. The cylinders are also provided with water injection, and forced lubrication is fitted throughout. Starting will be effected by compressed air at 200 lb. pressure supplied by two compressors driven by separate steam engines, and stored in four tanks each 3 ft. 3 in. diameter by 10 ft. high. A 15-ton hand operated overhead crane will be available throughout the length of the building.

3. OHIO STATE HIGHWAYS.

Brick Pavement on Athens and Chauncey Road, Athens County.

The new enginehouse at Abbey Mills is 180 ft. long by 42 ft. wide, and will contain seven centrifugal pumps with suction and delivery pipes of 38 in. diameter capable of dealing with a total of 150,000 gals. per minute. Each pump will be direct coupled to a vertical gas-engine having four cylinders over four cranks. The cylinders are 21 in. diameter by 24 in. stroke; the engines are designed to develop 475 b. h. p. at 180 r. p. m., and are fitted with piston rods, cross-heads, and guides as in steam practice. The cylinders and exhaust valves will be cooled by water circulated from seven vertical cylindrical tanks (each 11 ft. diameter by 24 ft. high) by small cen-

In ordinary circumstances the plant will pump the storm water from the low-level sewers entering the station to the high-level ones which pass close to it—a difference in level of about 40 ft.; but an alternative outlet to Channelsea river is provided for use in the case of exceptionally severe storms when the high-level sewers would be surcharged and unable to take the water. The admission of water from the low-level sewers is controlled by four hydraulically worked penstocks, two being 7 ft. 6 in. in diameter and the other two measuring 6 ft. by 5 ft. 6 in. It is hoped that the roof of the building will be erected by next spring, and that at least two or three

of the pumps will be ready for work during the summer storms of next year. The first gas-engine is now approaching completion, and will probably be tested at the maker's works in October next.

GLASGOW SEWERAGE.

The inauguration of the Southern districts sewage works on May 2, marked the completion of the Glasgow sewage purification scheme. Next to the undertaking of the London County Council the Glasgow scheme is the largest in the world. It has cost nearly $12,000,000 and taken twenty years to carry out. The territory stretches along both banks of the river Clyde for about fifteen miles, the superficial area being fully forty square miles. The completion of the scheme removes from the Clyde sewage of Glasgow and the adjacent burghs to the end that the Clyde shall once more become a clean river and a resort of the salmon. Prior to 1894, the whole of the Glasgow sewage was discharged without any purification into the Clyde.

The volume of sewage and the proportion of rainfall to be dealt with is estimated at 250,000,000 gallons per day. The drainage area is divided into three sections with separate works for the disposal of their sewage. The principle upon which the whole scheme is based is that of intercepting all the sewage in the ordinary sewers by means of special sewers and then leading these to one or another of the three purification works.

On May 2, as I have said, the finishing touch to the whole scheme was put

4. OHIO STATE HIGHWAYS.
Brick Pavement on Green Street Road, Washington County.

by the opening of the new pumping station at Kinning Park. Great difficulties were experienced in finding a site for this station, and when these were overcome it was found there were many difficulties in connection with finding good strong strata.

The pumping machinery raises the sewage from the intercepting sewer in St. James street and delivers it through two rising mains, each about three-eighths of a mile in length, into the main outfall sewer in St. Andrew's Drive. The net lift or head to be overcome is about 39.5 feet, and the resistance of friction of the rising main raises the total head to an equivalent of 46 to 48 feet. There are three main pumping engines, and every provision is made to receive a fourth engine with the least practicable trouble, and without disturbing the work of the pumps now erected. Two pumps are intended to deal with the present wet weather flow of sewage, the third being generally at rest as a stand-by, to allow for pump cleaning, adjustments and repairs. The greater part of the auxiliary machinery is driven electrically by current taken from the mains of the corporation.

The sewage enters the station through a penstock, 7 feet 6 inches in diameter, and passes first into a catch-pit, which is provided with a traveling grab-dredger, to lift the heavy grit and sand which are washed into the sewers from the streets. Turning at right angles from the catch-pit it enters three screening channels, each of which is guarded by an open bar gate or rough screen (to stop larger floating bodies), a penstock, and two fine screens of the lifting-gate type. The spaces between the bars of these fine screens are three-fourths of an inch wide. Having been screened, the sewage flows by distributing channels into the pump wells, which are separate for each pump, and each well can be isolated by its own penstock, for cleansing purposes.

In order to economize space and to leave some yard area in the station, the catch-pit chamber and the screening chamber are entirely below yard level. A small elevator raises the spoil from the catch-pit and from the screens to the higher level, that it may be carted away or burned.

The bottom of the pump wells is about 40 feet below street level, and the invert of the catch-pit 6 feet lower. The pumps are placed on heavy beams directly over the pump wells and the engines on similar beams at about street level. The former are of the triple-plunger type and the latter of the vertical triple-expansion marine type. The cylinder piston rods are directly connected to the plungers. Each engine and pump at normal full speed will raise 12,320 gallons, or 58 tons of sewage per minute. The surface condenser of each engine is placed on the delivery pipe of the pump, and all the sewage passes through the condenser tubes on its way to the rising main. Each pumping engine can be isolated from the main by means of a sluice valve on its delivery branch. Connecting pipes and additional sluices permit of any pump delivering into either of the two rising mains. Air vessels of liberal capacity are placed on the delivery pipes and on the pumps themselves, to steady the flow of sewage and to resist the effects of shocks which are liable to occur in the event of sudden stoppage and reversal of the stream in the rising mains.

The whole area of the pump-house is commanded by an electrically driven traveling crane capable of lifting the heaviest parts of the machinery. There are in the boiler house three water-tube boilers, with every provision for a fourth. One boiler is intended to provide steam for one pumping engine. The boilers are strong enough for 200-pound pressure, and steam is generated to a pressure of 180 pounds per square inch with a moderate degree of superheat. The steam pipes are of wrought steel, the feed pipes of copper and gun metal. Underfeed stokers are fitted to prevent smoke. There is a lightly forced draught below the grates and a liberal chimney to draw off the waste gases after they have circulated about the tubes of a feed-water heater or "fuel economizer." Duplicate pumps are provided for feeding the boilers from a feed tank which contains oil filters, and additional filters are fitted on the feed mains.

The Classification and Filing of Technical Memoranda

By Henry C. Adams, Assoc. M. Inst. C. E., A. M. Mech. E., A. M. I. E. E., London, Eng.

THE subject of classifying and filing the odds and ends of information which an engineer is constantly collecting is one which has received considerable attention in recent years, both in this country and in America, and the importance of obtaining and using a thoroughly sound system is generally admitted. The ideal system demands that all the information on any point must be collected in one place; it must be capable of easy expansion; it must be so elaborate that there is no doubt as to the probable whereabouts of any particular detail, and yet so restricted that expeditious reference is easy; it must be economical in first cost, and economical in working; that is to say, the time occupied in classifying, sorting, putting away papers, and getting them out again when necessary must be reduced to the lowest limit.

The matter to be dealt with in the filing system should be limited to small pamphlets, leaflets, newspaper cuttings, etc., leaving the larger pamphlets and bound catalogues to be dealt with separately, and it must be remembered that the matter to be filed comprises papers of every conceivable shape and size.

Every new departure, invention or improvement is generally first announced through the medium of advertisements, and an engineer must study them to keep in the forefront of progress. Items worthy of preservation are often found in the advertising pages of the technical journals, and surely the advertiser's highest ambition is attained when his insertions are cut out and preserved for future reference by those whose attention he wishes to attract. Many advertisers fail to recognize that an insertion which merely advertises the maker's name and includes a photographic reproduction of a machine or article to a microscopic scale is generally valueless to an engineer, although it may appeal to the man in the street. An engineer has so much valuable material to his hand at the present day that he can find no room to collect information which can probably be found equally well in a trades directory. It is problematical whether there is any truth in the suggestion that the majority of engineers were directed into the profession because of their uncontrollable desire in the days of their childhood to see the inside of things, and ascertain the nature of the construction and motive power of their toys, but there is no doubt that in after years such a desire must be strongly developed if an engineer is to become a master of his profession.

The essentials of an advertisement, therefore, should consist primarily of sectional details to show the general construction of the article, and to explain the method of its working; secondly, a photographic reproduction, to a reasonably large scale, of the exterior view of the article, and, finally, of a brief, pointed, technical description, in ordinary "long primer" type, of its special advantages, and the main points wherein it differs from similar articles made by other firms, omitting all those generalities to which the thing must obviously, by its very nature, conform. The name and address of advertiser, with name and date of periodical, complete all that is necessary, and the whole should occupy as compact a space as possible. If the advertiser wishes to have a whole page advertisement, let the essential part, as outlined above, be printed in one corner. The remainder of the page can be left blank, or carry some special mark to attract the desired attention according to the advertiser's taste; it is immaterial to the engineer.

Probably very few of the circulars and smaller catalogues which occupy so much space in the post-bag each day are preserved by the recipients, because of the difficulty of knowing how to deal with them. In one case a pamphlet of several pages may be used to convey information which could better be given on one sheet, and housing room is grudged for unnecessary paper. In another case one sheet of paper may bear advertisements of nearly every line followed by the merchant, from nails to locomotives. Then there is the booklet which would be very convenient for carrying in a waistcoat pocket if one wished, but usually one does not; and at the other extreme are the placards which cannot be opened out until a desk is cleared. Finally, there are the books which are sent out

bearing the label "Please hang this up." If the advice were followed in all cases, the condition of the office walls would soon remind one of the recently suggested method of reinforcing concrete by mixing tenpenny nails with the aggregate, and it is probable that the decorative effect might leave something to be desired.

For convenience in filing, it is requisite that each line or subsidiary branch of the firm's products should be dealt with in a separate catalogue or pamphlet, or on a separate page, all publications being of one standard size, and that when leaflets are used each sheet should contain complete information about one article, and one only. The question of what should be kept or discarded depends upon the extent of the ramifications of one's practice, and also upon the depth of knowledge possessed in the various branches. As knowledge increases, many of the notes which were of service in less experienced days can be removed and destroyed; it is, however, rarely desirable to preserve items of only passing interest.

The writer has at different times tried many systems which it is needless to describe, as they were each discarded in turn because they failed to satisfy in practice the requirements demanded of them. The index must be arranged on a subject basis, but it is obviously impracticable to index every separate piece of paper. The successful working of the system hereafter explained depends upon the skill displayed in drawing up and from time to time elaborating the index. The index adopted by the writer's firm is arranged in sections under headings representative of the main branches, each section being subdivided to deal with the secondary branches, which are in turn divided up to the extent necessary to deal with specific details, and a number is allotted to each entry in the index. The following extract from the index itself will show its comprehensive range, and at the same time the extent to which detail matter is separately included:

INDEX.

ADMINISTRATION.

1 Office requisites. 1A Instruments. 1B Slide rules and calculating machines.
2 Office furniture.
3 Printing and lithography. 3A Photo-printing.
4 Tracing, professional assistance, translations.

AGRICULTURE.

8 Agricultural notes. 8A Farming tenancies.
9 Farm buildings, stables, horses, alphabetical order down to cowhouses, carting.
Etc., etc., in alphabetical order down to

WATER SUPPLY AND HYDRAULICS.

250 General notes on water supply.
251 Water charges, regulations, and forms.
252 Discharge of pipes and weirs.
253 Water softening and hardening. Lead poisoning.
254 Purification and filtration of water.
255 Distribution of water, meters, domestic supply. 255A Water supply fittings.
256 Wells, boreholes and pumps.
257 Impounding reservoirs. 257A Reservoir and barrage dams. 257B Gathering grounds.
258 Utilization of water power. 258A Water wheels, turbines, etc.

It will be noticed that in some cases two or more important subjects are coupled together under one heading, when at first sight it would appear to have been better to separate them, but the reason for this is that a large proportion of the notes collected on one subject are found to contain information relative to the other, and therefore to avoid a lot of cross-referencing they have been grouped together. For example, tramways and railways have a connecting link in light railways, which may be passenger tramways or heavy goods railways. On the other hand, some minor details acquire prominence by having a special entry allotted to them, the reason being that they have been crowded out from association with more important papers. The aim throughout has been to make the system fit the needs, and not to adhere slavishly to any preconceived idea of order and regularity.

All papers are kept loosely in strong cardboard boxes, specially made for the purpose by the Cardboard Box Company, Florence street, Birmingham. These boxes are 9 by 13½ inches and have both the lid and the box three-fourths of an inch deep; a length of red tape to tie at the edge, fastened safely to the box, is provided for keeping them closed. The boxes can stand on edge in rows on the bookshelves, and should have their distinguishing number stencilled on the exposed edges. They have a neat appearance, can be picked out without trouble, and are easily dusted. The method of fastening might be improved, and a spring clip inside would be useful, but the boxes have the merit of cheapness,

costing in their present form less than 1½d. each. A supply of stout, clean, bright-colored foolscap paper completes the outfit.

The method of working can be best explained by taking an actual example, say reinforced concrete (No. 185). When this subject was first introduced, the notes upon it were not numerous, and were put haphazard into the box. Soon the notes accumulated sufficiently to make it desirable to sort them; this was done under sections relating to floors, bridges, chimneys, jetties, etc., and as the total number was not more than enough to fill the box they were replaced, but each branch was separated by a piece of the colored foolscap paper, bearing the distinguishing number 185A, B, C, and D, respectively. In the course of time the matter collected increased to such an extent that one box would not hold it all, when one or more sections were removed bodily into separate boxes, which were marked with the distinguishing numbers of the sections concerned. The other sections remained in the original box, so that if 185C was wanted, and on examining the shelves it was found that there was no box bearing that number, it was known that the matter was not very bulky, and would be found in box 185. If at any time a box bearing a letter as well as a number required subdividing it could easily be done, using figures as 185A1, 185A2, and so on.

When a sufficient number of papers deemed worthy of preservation have accumulated in the office a senior assistant rapidly glances through each one to ascertain its character, and marks it with the number of the box to which it should go. The papers are then handed over to a junior, who sorts and places them in their respective boxes. Although the proposed method does not in any way depend on the possession of a good memory for its successful working, still, after a very short time, the various headings, and even the numbers, easily become impressed upon one's mind, thus facilitating the marking of papers. Each piece of paper being loose, can easily be taken out when required for any special purpose, and when it is finished with, the box in which it should be replaced it is at once seen by reference to the number which was marked on the paper when it was put away originally. Specific cases may be adduced to which the foregoing observations do not wholly apply, but it will probably be easy to suggest modifications to suit varying circumstances.—*Surveying and the Civil Engineer.*

The New Gravity Water Supply for Pulaski, Va.

By G. H. Derrick, M. Am. Soc. C. E., Pulaski, Va.

DURING the summer of 1908 the town of Pulaski, Va., had an epidemic of typhoid fever, which was traced to their water supply, consisting of five wells situated in a flat near a branch about one mile northeast of the town. The branch runs through a farming section, and the formation is limestone. After extended examination, it was decided to install a storage gravity system. A water shed of 1,740 acres lying on the north side of Drapers' Mountain, and some three miles southwest from town, formation sandstone, practically uncultivated, was acquired and will be inclosed. The impounding lake covers thirteen acres and holds forty-four million gallons. Fifteen thousand feet of 12-inch cast iron pipe has been laid, having a head of 216 feet above lowest part of town. The reinforced concrete dam is 151 feet from spillway to spillway and 37.6 feet high at lowest point. The spillways on each side are 20 feet wide and 30 feet deep, cut into hillsides and surfaced with concrete for 25 feet; side walls extend same distance below dam and are 3 feet high, providing against any overflow at crest of dam. Buttresses, 1:3:6 concrete, are spaced 10 feet centers, 12 inches thick at top and 18 inches at lowest point, having footings 2½ feet wide and into solid rock. The deck, 1:2:4 concrete, is 13 inches thick at top, and about 20 inches at base, with a cut-off wall 3 feet 9 inches wide, and extending into solid sandstone. Face of deck has a batter of 10 inches to the foot, and the buttresses batter 2 inches in 1 foot down stream. The crest is 18 inches thick and 2 feet 3 inches wide on top. The deck is reinforced with ⅞-inch square horizontal bars, spaced 4 to 8-inch centers,

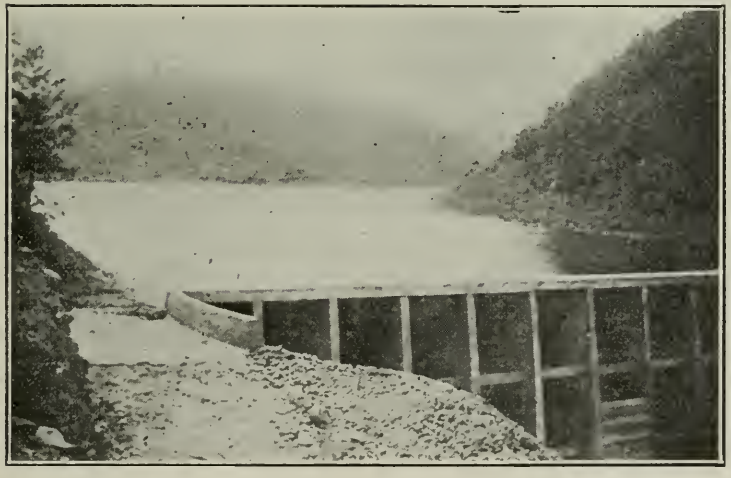
crossed every 2 feet with ½-inch square medium steel Havemeyer bars, clamped at intersection with the "National Chair." Five feet of wire cloth, 3x6, No. 9, was placed near the surface at the top, and two sections of 20-pound T-rail were also placed near the two top edges. One coat of No. 60 Elaterite water-proofing was used on surface of deck. The dam was designed so that an addition of 9.6 feet could be made, giving a reservoir capacity of eighty million gallons. There are three intakes of 12-inch flange pipe, fitted with flap gates worked from underneath deck, and covered with 2-foot square brass screens set on concrete. The pipes are strapped to side of buttress and pass into a 1½x4-foot intake well with cast iron top. A screen is in center of well and a 6-inch blow-off is for removing sediment. Four additional valves regulate intakes. A 24-inch cast iron pipe is located in bottom on opposite side of chamber, having a sluice gate and extra valve connection, all operated from underneath deck.

About twenty-one tons of reinforcement and 1,000 barrels of Old Dominion cement were used, 1:2:4 concrete, 370 cubic yards, and 1:3:6 concrete, 335 cubic yards.

The lump sum contract price for building dam and laying pipe line (the town furnished, f. o. b. Pulaski, all pipe, specials and fillings at dam) was $15,520. Cost was estimated as about equally divided between dam and pipe line. Material outside of contract cost about $15,000, and the water shed and other expenses made the whole project run something over $40,000.

Contractors, Lowe & Shoecraft, Bristol, Tenn. Engineer, G. H. Derrick, M. Am. Soc. C. E., Pulaski, Va.

The town began using the water on May 10, and within thirty days the dam was running over spillways, and on August 20 the water was 2 feet below the spillways.



REINFORCED CONCRETE DAM, PULASKI, VA., WATER WORKS.

Municipal Improvements in Richmond, Ind.

IF the municipal improvements of Richmond, Ind., are a true indication of her financial condition, then her boastful nickname "The Panic Proof City" is well applied. The streets are all broad, well paved and clean, and in most of the town are arched by trees that are a noticeable feature of the city. The streets are designated by letters, beginning at Main street and running north and south; and by numbers running east and west from the river. The street signs are of brass letters placed in the sidewalks on alternate corners of the street; the old system was that of the metal signs placed on posts. These latter are rusted so as to be very indistinct, and the former are, like most of that type of street sign, difficult to see from a passing vehicle or street car.

Parks.—Richmond maintains a park system that is worthy of note. The largest park is known as Glen Miller Park and includes about 160 acres, at the eastern limits of the city. This park is left almost in its natural state of wild beauty in the eastern half, while the western portion has been improved by drives, bridges across the small stream flowing through the park, and a small reservoir. In the improved part are pavilions, barns, sheds and shelters for the animals, of which there are several of the wild species native to this region. The smaller parks are of the usual type to be found in a city of this size. The acreage of parks is:

	Acres.
Glen Miller Park	161.0
South Seventh Street Park	2.6
South Tenth Street Park	2.19
Starr Park	1.14
Riverside Park (most of this ground recently purchased)	4.
Total	170.93

In addition to these parks, the school department maintains a playground which is valued at $10,000, including improvements and equipment.

Sewage Disposal.—The sewage disposal plant is located about two miles west of the city, on ground owned by Earlham College. The plant consists of a settling tank discharging by siphons alternately into four contact beds. The settling tank consists of a 10x10-foot grit chamber and four 22x20x6-foot settling chambers with center baffle walls. In the last chamber are four 12-inch siphons set to operate alternately. The tanks are of waterproofed concrete of monolithic construction, and the tank walls form the walls of the building, which is closely sheathed and roofed in. The contact beds consist of 3 feet of gravel underlaid by 4-inch drain tile and are 50x100 feet in size. Each is used on the average of two times a day.

Garbage Disposal.—The city garbage is collected in five water-tight wooden wagons and hauled to the crematory on the river bank. Four of these wagons have regular routes, while the fifth is held for the purpose of making "emergency" calls. The crematory is a frame, corrugated iron building covering the oven. The single oven is of 11 yards capacity and is designed to take care of both wet and dry garbage. No attempt is made to separate the materials further than to pick out the cookies, crackers, good fruit, etc. This material is used to feed the animals at the Glen Miller Park menagerie. The ash, after having the stones, glass and tin picked out, is used in constructing a driveway down the bluff to the crematory and power plant. The capacity of the crematory is insufficient to take care of all the garbage during the summer months, so that about one-third of that collected is disposed of in the old manner by dumping in the country.

Street Lighting.—The streets are lighted by arc lights placed at every street intersection in the business and more thickly settled residence district. The dense, heavy foliage of the trees makes the lighting seem inadequate, though it is better, perhaps, than most cities of the same size. The arcs are operated by the municipal lighting plant at a cost of $43.85 apiece a year, including current and trimming. However, no rental is paid by the city, as the private service of the company more than pays for the street lighting at the present time.

Electrolysis.—The Indianapolis-Richmond interurban line and the Richmond city traction lines maintain their rail bonding in fair condition. But the Dayton-Richmond return circuit is said to be in poor condition. Considerable trouble has been reported from electrolysis, but no tests are made by either the city or the water works department, and no steps have been taken to lessen the trouble, other than to bond the water mains to the negative bus bar at the power station.

At first impression Richmond seems to be merely an overgrown country town, an impression gathered, perhaps, from the broad streets and the customary Main street with its comparatively narrow stone or concrete sidewalks and its street car line operating tiny cars at infrequent intervals. This first impression, however, meets with a radical change when inquiry is made into the management of municipal affairs. The system of management of municipal affairs is excellent. Party feeling is very radical in the city, yet in the control of such departments as the municipal lighting plant, the city engineer's office or any other department requiring personal ability, the question of party or politics is not allowed to enter. To this fact and to the excellent system of office management, as perhaps is best shown in the system of office records and accounting in the city engineer's office, may be attributed the present progressive condition of Richmond, the municipality.

More detailed descriptions of the electric lighting plant, the special forms of street construction and the water works will be found elsewhere in MUNICIPAL ENGINEERING in both past and future numbers.

A Sand and Gravel Plant

IMPROVING the highways is largely a local problem. Numerous investigations are being conducted for ascertaining and determining the most practical and economical methods of improving roads. The various results are exceedingly interesting and differ according to the existing conditions.

In the early extensive road improvement in the central and southern parts of the western half of Ohio gravel was used for the wearing surface. This early work was practically confined to the region where an abundance of gravel is found. The highways in and around Columbus have been improved rapidly in the past few years in a similar manner. The foundation bed in practically every instance is very hard stone and the wearing surface is gravel. The use of the stone is due to the extensive gravel formation in the western part of Columbus and vicinity, although strata of solid limestone and granite also occur.

In the Scioto valley, in which Columbus is located, large areas are made up of alternating strata of sand and gravel. The latter is abundant in sizes grading downward from pieces as large as an egg. Most of it consists of flint, extremely hard granite and limestone, and many small boulders form a part of the deposits. These deposits were brought down by glaciers, the water from which carried large masses of debris, such as sand and gravel, and in the course of time these were deposited over a widely extended territory. In this manner the valley was partly filled, and it is the opinion of geologists that the entire western side of the valley is sand and gravel at the bottom. In some places the cover of soil is of such thickness, however, as to make impracticable any idea of developing the gravel deposits commercially.

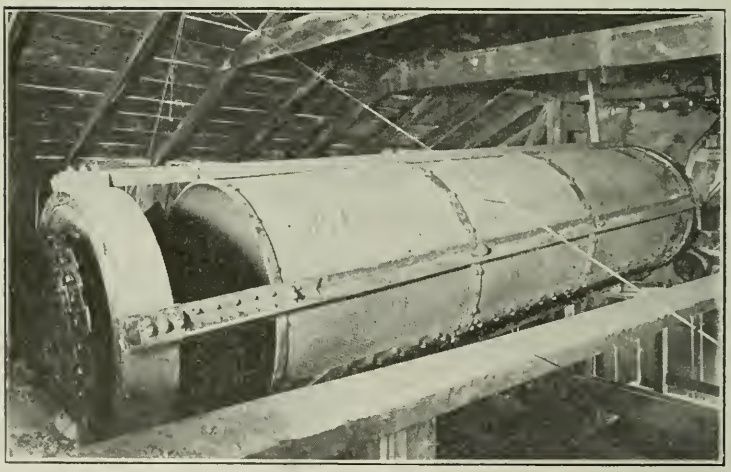
The Mt. Calvary Sand and Gravel Company operates near Columbus, O., a small plant for excavating and preparing sand and gravel for various purposes. Most of the output of the plant is used for surfacing macadam roads in the vicinity of Columbus. A considerable demand for concrete material also is supplied.

When this gravel pit was opened several years ago some 24 to 30 workmen were required to operate it. Within the last year a mechanical installation has been made, which enables nearly 80,000 cu. yd. to be excavated, washed, and delivered to cars or wagons each year, with an average force of only 9 men.

A steam shovel with a ⅝-yd. dipper is used for excavating the material and loading it in 1½-yd. side-dump cars. A portable plank track provided for the steam shovel permits the latter to move about the dippings readily. The shovel handles from 400 to 600 cu. yds. per day, working against a face 15 to 25 ft. in height. One of the accompanying photographs shows car discharging into hopper and also conveyor line.

The cars deliver the material to a receiving hopper placed below the ground surface at a distance of 150 ft. from a screen house. At the bottom of the hopper is a four-way adjustable plate feeder for delivering the mate-

1. PLANT FOR SUPPLYING SAND AND GRAVEL



2. SCREEN IN COLUMBUS SAND AND GRAVEL PLANT.

rials to a belt conveyor. This feeder is operated by a crank and connecting rod driven from the foot-shaft of the conveyor. The crank is fitted with an adjustment, which enables the flow of the materials to be regulated from 200 to 400 cu. yds. per day, according to the desired capacity. The feeder is built with concentrating side plates, which gather the sand and small gravel and deliver them to the center of the trough-shaped belt conveyor. The latter transports the materials up an 18-degree incline on a trestle to the top of the screen house. The conveyor is a 16-in. Jeffrey five-ply rubber belt, having an extra rubber cover, and travels at a rate of 250 ft. per minute.

Approximately 50 per cent. of the deposit in which the pit is located consists of sand. The latter forms a convenient bed for boulders measuring 8 to 12 inches in diameter, so they are carried up on the belt without rolling. The conveyor discharges the material to an inclined Jeffrey revolving screen. An accompanying photograph shows this screen in the upper part of the screen house. The screen separates the sand from the stone, the sand dropping to bins below it, while the tailings are dumped through a chute, set at an angle of 40 degrees, gravitating to a crusher. The latter can be adjusted for reducing the boulders to sizes between ½-in. and 2½-in. cubes, and discharges into a bucket elevator of the continuous Jeffrey type. This elevator has buckets 12 in. long by 8 in. wide and 12 in. deep, mounted on a continuous chain, and delivers the output of the crusher to a second revolving screen. The latter separates the material into four different sizes. The first part of the screen removes the dust; the second portion the pea-gravel; the third part of the screen removes the curbing or concrete gravel; and the tailings, consisting of 2½ to 3-in. pieces are used for heavy concrete and pavement foundation work. A 55-h.p. horizontal steam engine supplies power for operating the conveyor, elevator and screens.

The various sizes of stone are delivered by gravity to bins from which they are discharged through valves into wagons driven directly under the building. The bins also are arranged to discharge into railway cars on a track under the structure.

On account of a large portion of the deposits being sand, a washing system has been installed to insure a clean product. The sand is delivered by water from the bottom of the bin through a flume to two Jeffrey spiral conveyors, each set at an angle of 20 degrees in separate water-tight tanks. One of the spiral conveyors takes the sand from the bottom of the first tank and carries it into the bottom of the second tank. The conveyor in the second tank washes the sand again and discharges it directly to wagons. The water overflowing from both tanks carries away the loam and clay, leaving the clean sand.

EDITORIAL COMMENT

Indebtedness for Public Service Plant May Not Be a Municipal Burden.

Valuations of Public Service Corporations.

INDEBTEDNESS FOR PUBLIC SERVICE PLANT MAY NOT BE A MUNICIPAL BURDEN.

It has long seemed rather incongruous that a municipality which has reached its legal limit of indebtedness should be unable to construct or to purchase a public service industry and make the unpaid portion a lien on the property thus acquired, to be repaid from the net revenues of the plant. A recent decision made by the Supreme Court of Illinois opened a way by which this could be done in a particular case. The statement of the case is as follows:

Clay City in Clay county, Illinois, in 1907 granted to one Theodore Fisher the right to erect an electric light plant with all necessary equipment for the purpose of furnishing light, heat and power to the village for a period of thirty years. The village agreed to pay $70 per annum for each of twenty-three arc lights throughout this thirty-year period. Bonds were issued to the limit allowed by the State law—in this case $4200. These bonds drew 6 per cent interest and the proceeds from their sale were applied on the purchase of the plant, which was to be operated by the city. The balance of the value of the plant ($7296) was secured by a mortgage on the plant equipment and franchise rights, and the mortgage was held by the company which built the plant. In June, 1908, the board of trustees and the president paid $1440.57 interest on the bonds and on the mortgage indebtedness and one of the mortgage bonds. The taxpayers then filed a bill in the circuit court of Clay county, alleging that all indebtedness above the $4200 of bonds was illegal and void and all taxes levied for bonded indebtedness above the amount necessary to meet what was then due on the previous bond issue was illegal.

The bill was answered and an injunction was issued restraining the collection of taxes to pay any part of the mortgage indebtedness. The taxpayers in the bill made no objection to the purchase of the plant nor to the issue of the bonds, but they sought to have the village enjoined from paying any of the purchase price above the $4200, which would result in the loss of the plant and the $4200 paid upon it. From this decree an appeal was made to the Supreme Court.

The Supreme Court held that the only relief that could be had was to enjoin the payment of the mortgage indebtedness out of any other fund than the net income from the electric plant after paying all operating expenses and necessary repairs. It was held that a village or city does not create an indebtedness by obtaining property to be paid for wholly out of the income of the property.

It was further held that the agreement to pay $1610 annually for arc lights during thirty years would constitute an indebtedness for the entire amount and would be illegal. But the purchase of the plant by the village, immediately after its construction, put an end to the agreement and there was no reason for enjoining payment for the lights.

If the plaintiffs had not brought their suit in the form above described, whereby the city would lose its $4200 if the case were decided in the usual way, it is quite probable that the court would not have stepped outside the path which has been more or less clearly laid down in previous decisions. Indeed, the decision quotes approvingly a decision declaring a somewhat similar procedure illegal. But the manifest injustice of a decision which would cause the city to lose a sum which it had every legal right to spend

undoubtedly led to the formulation of a plan whereby the city could complete the program it had laid down.

The net result in this case is a statement that the thirty-year contract for street lighting would be invalid, but the purchase of the plant by the city had put an end to this agreement; a decision that a municipality does not create an indebtedness by obtaining property to be paid for wholly out of the income thereof! and an injunction against the city paying the indebtedness against the property out of any funds except the net revenues of the plant. The decision does not indicate the source of the plant revenues, but, in Illinois, cities are permitted to light their own streets and not to sell light to others, so that the only revenues of the plant would apparently be appropriations made by the city council. It would seem, therefore, that the only thing necessary to carry out the exact program laid out would be to change the form of the ordinance to make a direct appropriation to the electric light plant sufficient to meet all the requirements of the program. Unless, indeed, a municipal plant for street lighting only might be said to have no revenues, in the ordinary sense of that term.

If "a city or village does not create an indebtedness by obtaining property to be paid for wholly out of the income of the property (City of Joliet v. Alexander)," it would seem possible to devise some plan whereby a city could operate a public service plant and pay for it out of the earnings (barring such restrictions as that of electric lighting plants in Illinois referred to above), and make the holders of the evidences of indebtedness secure, within reasonable limits, for the city could increase rates to consumers and payments for service to the city until the excess of receipts over expenditures would, ordinarily, meet the obligations if they matured at a reasonable rate. The Clay City decision really leaves the city's original investment of $4200 somewhat in jeopardy, unless the city has such controls of the income of the plant as are suggested above, so that it can insure the meeting of the obligations as they become due.

If a plant is paid for wholly out of earnings and without municipal obligation other than one secured by the earnings, the usual objection made by the courts, that there is an attempt to secure by indirection an extension of the city's debt limit, does not apply.

If a plant is operated on the plan of the Citizens' Gas Company of Indianapolis, by a private corporation, limited as to profits, and passing to municipal ownership when the capital invested is returned to the investors under the regulations in the franchise, the same result is obtained, but until the ownership passes to the city, the plant is operated by the company and has the limitations regarding change of rates and of contract price for service to the city, to which private corporations generally are subject.

May not the Clay City decision be authority for a variation from former attempts to secure needed public service, which will require from the citizens proposing to supply it only a little more sacrifice, in that the city will not make any preliminary investment, and in that they will be subject to a greater extent to the whims of future city councils in fixing rates and payments for public service, so that the rate at which their investments and the interest thereon will be paid may be subject to considerable variations? If the aforesaid public-spirited citizens are willing to operate the plant until it has paid for itself, then some such plan as that of the Citizens' Gas Company, referred to above, would probably be best, although it might be modified somewhat to make municipal ownership arrive earlier, by giving the city such control over increase of rates as would hasten that time, if desired, and at the same time controlling distribution of profits within set limits so that the increase in revenue would reach the proper channel. However, it is probable that the citizens do not wish to operate the plant, but only desire to establish a plant for the city to operate. In such cases perhaps it will be possible to steer through the

contradictions and fine distinctions in the court decisions on similar projects and bring out something which a court like the Illinois Supreme Court will sustain.

VALUATIONS OF PUBLIC SERVICE CORPORATIONS.

A comparison between the results of the attempts to secure a valuation of the Detroit United Railway in order to secure a basis for a settlement of the present unfortunate conditions existing between the city and the public, with the simple, scientific and successful methods used in securing similar valuations of the property of public service corporations in Wisconsin, for example, demonstrates a number of interesting propositions.

In the first place, the mayor appointed a committee of fifty to investigate the situation and attempt a settlement. Neither this committee nor its sub-committee on appraisal was expert in the technical details, either engineering or financial, and could hardly be expected even to make a thoroughly competent choice of technical experts to guide them in their deliberations. Nevertheless, they made a choice and had an appraisal made. This procedure was so conducted, either by the committee or the sub-committee or the engineer, or through external manipulations, that it failed to reach an understandable conclusion, and the thousands of dollars expended seem thus far to have produced no result, and to have brought the committee back to the point of beginning.

Then the street railway company employed a committee of experts, selected with much better judgment, if measured by results, which is now ready to defend in any required way the details and the totals of its appraisement.

These two appraisements differ by more than the amount of that of the engineer of the committee of fifty, before it was reduced by the committee itself sitting upon the results of the work of its sub-committee.

Neither party has any right to send for persons or papers, neither party has agreed to abide by the results of an arbitration, each party tries to put the other on the defensive, and the consequence is a deadlock on the question of the beginning of an arbitration proceeding. The company is reported to be willing to agree to a board of valuation on which it will be represented, and the city council is considering a new appraisal at the expense of the company.

If Detroit were in Wisconsin, the street railway company could put itself under the State Railroad Commission and receive an indeterminate permit to operate its plant. Any reasonable number of persons considering themselves aggrieved by existing conditions could petition for change of fares, regulations, conditions of operation, etc., and, before the state board would make a decision which would materially affect the financial results of the operation of the company, it would make a thoroughly technical valuation of the company's property and determine the actual results of their operation of the plant. The company's books and records would be open to the commission, its valuation and statements of operation would be received and considered, hearings would be held, and a decision would be reached after thorough consideration of all the facts, with full power to ascertain those facts. This work is done by a commission which is expert because well chosen in the first place and because it is engaged all the time in this kind of investigation, so that it is familiar with all the variations of condition and circumstance. The commission is aided in the technical part of its work by engineers and attorneys, expert and experienced because equally well chosen and constantly employed.

The practical results for both company and city are incomparably better under the Wisconsin system, and the establishment of a Michigan commission or the extension of the powers of its state railroad commission under like statute provisions would be fully justified if it did no more than settle the Detroit difficulty.

THE QUESTION DEPARTMENT

Ordinance Requiring House Connections Before Paving Begins.

Could you give any information referring to a street ordinance requiring all permanent street improvements to be placed under ground before any permanent street pavement is put down, such as gas and water mains, sewers, electric and telephone wires, etc., or could you give me the name of any town where such an ordinance is in effect?

C. M., Galesburg, Ill.

The city of Atlanta, Ga., apparently passes an ordinance on the above subject in connection with the paving of each street. Thus sections 1242 and 1243 of the code of 1899 provide:

All property owners on Peachtree street are hereby notified to make all sewer, gas and water pipe connections from the mains on said Peachtree street within 30 days after the passage of this ordinance, preparatory to paving the same with asphalt. After the pavement is laid on said street it shall be unlawful to in any way cut the asphalt for the term of 5 years.

Section 1247 reads:

The Board of Water Commissioners are hereby required to have all water connections on North avenue between Peachtree and Williams streets made immediately so as not to delay the paving of said avenue. That the Atlanta Gaslight Company are hereby required to bring all gas connections on said avenue to the sidewalk curbing, and place the keyboxes before said North avenue is paved. Property owners are hereby required to make all sewer connections before said avenue is paved. That the said gas company, if they desire to lay a new gas main, shall do so before said avenue is paved; and after said North avenue is paved the said paving shall not be taken up to make any such connections for the term of five years.

There are numerous similar sections applying to other streets.

Camden, N. J., makes provision in Sec. 92 of the 1906 revision of the city ordinances, of which the following is an abstract: Prior to the paving, repaving, grading, macadamizing or other improvement of any street, highway, public place, or alley, or any part thereof, in the city of Camden, it shall be the duty of the Commissioner of Streets to notify all owners of real estate fronting thereon to make connections with culvert, gas and water mains, as approved by the Engineer of Sewers, to and within the curbline. And in case any of them neglect to comply with the said notice for 30 days, it shall be lawful for the Street Commissioner to contract with some person to do the said work, who shall, within 30 days after completion, make out a measurement of the work and account, showing necessary details and the total cost and proportion for each property owner for entry in city books. And the costs and expenses of performing the said work are a lien upon the real estate aforesaid until fully paid. And the contractor shall then proceed to collect the claims and receipt for them upon the books; at the end of six months after the completion of the said work, the City of Camden shall pay the contractor the balance remaining due. The contractor may sue for the amounts due with interest and costs of suit.

The city of Cleveland, O., covers the ground by one brief section, No. 1252, which provides:

Whenever the paving or repaving of any street or public highway shall have been ordered by the council, it shall be the duty of the Board of Public Service to duly serve upon such owners of property abutting on such street or highway, as he may deem necessary, a notice directing such owners to make such sewer and water connections as he may designate within a time therein specified. At the expiration of the time fixed, if such connections are not made as herein provided, the Board of Public Service shall cause the same to be made, and the cost thereof shall be temporarily paid from the general fund of the city. It shall be the duty of the city auditor to prepare and submit to the council, on the first Monday in September of each year, the necessary ordinance for assessing a special tax to reimburse the general fund for all disbursements, including interest on the same therefrom, for said purposes during the preceding year.

Detroit has a similar provision in three sections, 15, 16 and 17 of chapter 31 of its revised ordinances, regarding water, gas and sewer connections.

In Dubuque, Iowa, chapter 33, section 4, provides that the order to pave the street passed by the council is notice to property owners to make "gas, water, sewer, steam heating and all other necessary connections," but there is no penalty for failure other than increase in cost and in difficulty of getting permit for the excavation.

Evansville, Ind., in Ordinance 465, two sections make it the duty of the Board of Public Works to order private connections with sewer, gas and water pipes and to bring them within the curb, and if not obeyed to make the connections, and notify the controller of the actual cost, which he must put on the tax duplicate for collection with other city taxes on the same property.

Hammond, Ind., has a like ordinance, using more words to express the same instructions.

In Harrisburg, Pa., the city engineer must notify property owners on street to be paved, before contract is finally awarded, to make sewer, gas, heating, water or other connections within stated time, not exceeding 60 days, and if they do not obey they are subject to fine not exceeding $100 on conviction before the mayor or any alderman.

In Hartford, Conn., the board of street commissioners may order pipes and conduits in street to be relaid, renewed, repaired or located to prevent future disturbance of the new pavement, and on failure of person or corporation to obey may apply to the Superior Court for a mandamus. Another section requires private gas pipes to be relaid before pavement is laid, and if not done board notifies gas company to cut off the connection. Notice states period, not exceeding 10 years, within which no excavation will be permitted in new pavement. Sec. 113 of the city ordinance provides for notices to gas, telephone, telegraph and electric light companies and water commissioners by publication 6 months before date of beginning paving, all connections to be completed 3 months before such date.

In Kansas City, Mo., the board of public works notifies property owners and corporations interested 60 days before improvement begins, and that no permit for excavation that will disturb the pavement will be issued after the pavement is completed, according to Section 587.

Lafayette, Ind., has quite an elaborate ordinance of eleven sections, providing (1) that no street shall have a permanent pavement until the underground pipes and conduits are laid; (2) for notice to the water works trustees and those having rights to lay pipes and conduits in streets and that in case they do not lay or repair pipes no later excavations will be permitted except on account of accidents; (3) that within 30 days all mains and service pipes between curbs shall be completed and one of each type of service for each lot not built on and for each 66 feet of unplatted ground; (4) for notice to property owners by delivery and publication to make sewer connections, and that if not made within 30 days they will be made by city and assessed on property; (5) providing for letting contract for house sewer connections by the year or otherwise as above provided, for permits for excavations and for marking ends of unused connections; (6) for making water taps by water works trustees and assessing cost on property owner; (7) for city engineer making assessment list for adoption by council to make liens on the property served; (8) that the cost shall be actual cost of contract and advertising, inspector, enrollment and release fees; (9) that city clerk on confirmation of list shall issue to contractor certificate of assessment for each piece of property affected which he can then proceed to collect; (10) for $100 fine for violating ordinance; (11) for enforcement of ordinance on two weeks publication after passage. A supplementary ordinance provides for an inspector of gas, water and sewer trenches, and for permits and licensed contractors, and details of procedure to secure good work.

In Omaha, Neb., the city engineer is required to notify resident property owners, lessees, or agents, water and gas companies by publication or otherwise at least 20 days before contractor begins work, setting time for completion of house connections, from which time until the pavement is completed and formally and finally accepted by the city no permits for house connections will be issued. By another section the water and gas companies are required to make house connections and repairs to point beyond curb so as to supply each lot with gas and water without tearing up or opening the completed pavement.

In Rochester, N. Y., all water and sewer connections are made part of the street paving contract, as well as repairs and cleaning of sewers and water mains.

Saginaw, Mich., has an ordinance with 14 sections providing (1) that the Board of Public Works shall notify property owners to make house connections for sewer, water and gas within 10 days or the Board of Public Works will make sewer and water connections before new pavement is laid and assess the cost against the lots so served; (2) provides method of serving notice by messenger to resident owner or agent of non-resident or by registered mail to last known address or by posting notice in Board's offices, officer to make affidavit of services of notices; (3) provides method of keeping cost and assessing against property if board does the work; (4) provides for hearing appeals from assessments; (5) Council hears appeals; (6) confirmed assessments are collected as are other special assessments; (7) taking up new pavement without permission of Board is forbidden; (8) provides methods and circumstances under which permits for cutting into pavements may be granted; (9) provides that applicant shall pay $1 per lineal foot of excavation and the expense of taking up and relaying pavement as well as excavation and puts the money so collected in highway fund of district; (10) superintendent of public work is directed to take up and replace pavement; (11) precautions against accident and for prompt work by property owner's agent; (12) ordinance does not interfere with work in progress at time of its passage; (13) fine for violations of ordinance up to $100 or on default up to 90 days in jail; (14) repeals former ordinance.

Trenton, N. J., provides that no pavement shall be laid until the sewer connec-

tion with each lot on the proposed improvement has been laid to the curb line; also that notice shall be given property owners to make water and gas connections within 20 days on penalty that no further permits for such connections will be granted for 5 years.

The charter of the city of Troy, N. Y., provides that no street shall be paved until sewer and water mains are laid to serve the property, and also provides that the house connections must be put in and assessed as part of the cost of sewer and water main construction. It also provides for notice by the city council to property owners on streets to be repaved to make such connections and to assess fines if they do not comply with the notices.

These examples cover most of the plans for such ordinances. The details differ according to the laws of the States, particularly the assessment laws, the forms of city government, the contracts or franchises of public service corporations, etc. For any particular State and city the ordinance should be prepared by the city attorney or some one else familiar with the laws and customs of that State and city.

Charges for Engineering Services.

As one of the elements of professional ethics should be the charging of a just amount for professional services, I should like to ask some information as to proper charges for engineering work in Indiana, say. Is it generally figured as a percentage of the cost of construction. For instance, what would be a reasonable charge for the work on the construction of a dam and reservoir, including preliminary levels and measurements, levels for clearing and stripping reservoir site, designing dam and spillway (the latter of concrete with a concrete bridge spanning the opening, costing $5,000; the remainder of the dam being of earth, and making a total cost of $8,000), staking out and having general oversight during construction. It is not desired to make the charge on a basis of "get all you can," or "what the traffic will bear," but only a fair, honest, reasonable amount, considering the nature and amount of the work.

F., ———, Ind.

There is no custom regarding charges for engineering services. In Indiana the estimation of the value of engineers' services is ordinarily very low, due, probably, to the impossibility under the constitution of fixing the qualifications of the only official engineer with which the general public comes in contact, the county surveyor, and the low standard of qualifications ordinarily required of city do county work independently of the engineers and of engineers employed to county surveyor. It has been difficult in the past for the engineer to secure a per diem for work done of more than $5 and almost impossible to reach beyond $10. Gradually the standard is being elevated and the compensation is increasing at the same time, but reasonable figures have not yet been reached except at rather infrequent intervals.

A rather common method of securing better compensation, sometimes at the expense of the quality of the work, is to offer to complete the engineering work or some definite portion of it for a fixed sum. If the engineer does not make a safe estimate, he may be in worse condition than if he were on a per diem basis, unless he succumbs to the temptation to make himself whole by slighting his work somewhere. There are existing examples of each occurrence. Very few contracts for engineering work have been taken in Indiana on a percentage basis and notwithstanding the fact that this is the fairest to both parties and is the method commonly followed by architects, some mechanical and electrical engineers, and others, it is not popular among employers, and probably will not be until engineers show more interest in the financial condition of the profession at large than they have heretofore. The engineers of the State should adopt a standard schedule of charges as a means of educating the public to the value of really good service even if they are sure that few, if any, of the engineers of the State will follow it exactly. In fact, conditions will very often require more or less modification of any form of schedule that is likely to be adopted. But the existence of such a schedule and the earnest efforts of engineers to get as near to it as possible will bring vastly better results than the present lack of any scale of prices whatever.

Pending the adoption of such a schedule, MUNICIPAL ENGINEERING has answered such inquiries as the above by quoting the schedule printed in vol. xiii, p. 197. This schedule applied to the present case would authorize the following charges: Preliminaries, 1 per cent; plans and specifications, 2 per cent; details, 1 per cent; supervision, 1.5 per cent; engineering superintendence, 3 per cent; alterations, 5 per cent of value of work involved in the alterations. Apparently the case in hand would include the first four items, at least, or, in all, 5.5 per cent, or possibly the first three and the fifth, or, in all, 7 per cent, according to the responsibility of the engineer and the consequent necessity for close superintendence of the work. The former would make the total engineering charge, including all services of assistants, $440; and the latter, including all inspectors, $560.

Some consideration is given the subject in the July number, vol. xxxix, pp. 36 and 37, and in vol. xxxviii, p. 346, the latter giving a list of previous articles on the same subject.

Will our readers join in this discussion and give some idea of their own experience not alone in Indiana but throughout the country?

Dumping Catch Basin Refuse in Sewer.

On page 564, vol. 41, of 1900 *Engineering and Building Record,* I learn that one large city in your State is dumping catch basin material into the sewer. If you can learn the name of the city, what affect, if any, has it on the sewer? We are figuring on adopting this in Chicago, hence I am anxious. L. M., Chicago, Ill.

Probably the city of Indianapolis is referred to. The practice in that city is to wash at least a part of the catch basin refuse into the sewer, by means of a hose, which introduces water under rather low pressure into the basin.

The theory upon which catch basins are designed, is to keep street refuse from entering the sewers, and in cities upon as level ground as Indianapolis and Chicago they are fully justified by the relief they give to the sewer cleaning gang, and the prevention of stoppages of sewers at times of heavy rains. If the sewage must be pumped, as is now required for some Chicago sewers and will be for others, and as will be required in Indianapolis when sewage purification begins, the value of the catch basins is again demonstrated, both in the pump well and in the sewage disposal plant.

Catch basins must be kept clean if they are to fulfill their office, and cleaning catchbasins is expensive, especially if the dirt in them must be lifted out and carted away. The temptation is great to dump this dirt into the nearest sewer, either through a manhole or by washing it out of the basins directly into the sewer. If the sewage is to be pumped or purified, this should not be permitted; if not, the question is one of relative expense of removal. The Indianapolis plan, when the basins discharge into large sewers with deep, constantly flowing current, seems to work well. If the sewers are small and the flow of sewage at maximum rate is very intermittent, the catch basin refuse will sooner or later cause stoppages of the sewers, or, if the sewers are cleaned at frequent intervals, will require more labor to keep them clean. It is difficult to say how much cost of sewer cleaning should be charged to the Indianapolis method of disposing of much of its catch basin refuse, so that no really successful defense of or attack upon the method can be made. In Chicago the river must be dredged to remove the accumulations of street dirt and the cost of this operation would be increased by adding the catch basin refuse. It is quite possible that this method of removal is less expensive than that of lifting the dirt from the basins and hauling it long distances in wagons.

For free flow of sewage into a free outlet, the control of storm debris by the catch basins and the subsequent discharge of this debris, with sufficient addition of water, into sewers with large flow of sewage may readily be justified. Like discharge of the debris into smaller sewers or in large quantities at one time or place should be discouraged as likely to cost more for sewer cleaning than is saved in catch-basin cleaning. And when the sewage must be pumped or purified this method of disposing of catch-basin refuse should be prohibited.

The article referred to in the inquiry gives the following figures concerning cost of cleaning catch-basins:

COST OF CATCH BASIN CLEANING IN AMERICA

Frequency of Cleaning	Cost Per Year			Cost Per Cleaning			Cost Per Cu. Yd.			No. of Cities Rep'g
	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	
When full, necessary or offensive	$10.00	$3.00	$5.00	$4.00	$0.26	$1.74	$1.60	$1.08	$1.34	21
After a heavy rain	.....	....	....	....	....	....	....	....	....	7
1 to 3 times per year	3.36	1.50	2.15	1.21	0.30	0.69	....	....	1.15	14
4 to 6 times per year	4.50	3.36	4.03	....	....	0.40	....	....	1.15	8
7 to 9 times per year	.....	....	1.34	....	....	....	....	....	....	4
10 to 12 times per year	.....	....	....	....	....	....	....	....	....	5
More than 12 times per yr.	13.90	3.00	8.15	....	....	...	....	....	....	7
Total cities reporting										66

Ninety-two per cent of catch-basins are cleaned by the city.

Four hundred yards per year is the average amount removed from catch-basins.

Twenty-eight cities use the old bucket method.

Wilmington, Del., has a removable bucket placed in the bottom of the catch-basin.

Boston has tried the vacuum method.

Books on Cemetery Designs.

I would consider it a great favor if you could and would give me some information on the platting or laying out of cemeteries and where I could purchase books on this kind of work.

I. R. B., Port Allegany, Pa.

The books listed in MUNICIPAL ENGINEERING, vol. xxxviii, p. 113, on landscape gardening will aid in such work.

Parsons's "Landscape Gardening" ($3.50) gives some direct consideration to the laying out of cemeteries. Mr. Waugh has in preparation an American edition of Kemp's "Landscape Gardening" which should be of value also. *Park and Cemetery,* is a periodical published in Chicago ($1 a year) which is devoted to the details of such work.

Plans for City Halls.

We are anxious to get some prints, some that would be of service to us in way of suggestions for modern city halls; perspectives, elevations and floor plans of buildings ranging from 30 to 50 thousand dollars. W., Salina, Kan.

Bicknell's "Public Buildings" ($2.50) and Palliser's "Court Houses, Village, Town and City Halls, etc.," ($2) give some suggestions that may be of value.

The *Brickbuilder and Architectural Monthly* ($5 a year), 85 Water street, Boston, Mass., has published some such plans.

Can our readers refer to other sources of such information?

Fire Underwriters' Electrical Code.

Can you advise me as to where I can secure a copy of the National Electrical Code of the National Board of Fire Underwriters and copy of the List of Electrical Fittings by the same board? An ordinance has been passed here requiring all electric wiring to be according to the specifications of the National Fire Underwriters, and I have been appointed inspector.

N. W. GREEN, City Engineer,
Helena. Ark.

Copies of the code should be obtainable from the local representatives of companies under the National Board of Fire Underwriters, or the agent having supervision over inspections in the State. The "National Electrical Code" and the latest semi-annual issue of the "List of Electrical Fittings" can doubtless be obtained also of the "Electrical Bureau of the National Board of Fire Underwriters" either at 135 William street, New York City, or at 382 Ohio street, Chicago, Ill.

Lining For Reservoir.

There has been some talk of putting in an emergency reservoir to hold about 200,000 gallons. It is on a side hill where the ground would be solid but would doubtless have to be puddled. How thick would the clay puddling have to be? The water would be perhaps 10 or 12 feet deep.

I have some willows growing on the edge of the reservoir. Is there any way of killing them without pulling them out by the roots, which in this instance would be quite difficult?

O. O. L., ——, N. Y.

The subject of linings for reservoirs is well discussed in such books as Turneaure and Russell's "Public Water Supplies," ($5), Folwell's "Water Supply Engineering" ($4) and Goodell's "Water Works for Small Cities and Towns" ($3). The three agree very nearly upon 18 to 24 inches as the thickness of such a lining; that the slope of the reservoir sides should be from 1½ to 2 horizontal for 1 vertical; that ordinarily the clay must be protected from the direct contact of the water by stone, brick or concrete lining from 4 to 8 inches thick, but that under favorable circumstances a gravel layer may be sufficient. Pure clay is not recommended, but various mixtures with gravel or with sand and gravel are quoted. Some failures under peculiar circumstances have occured under the most approved methods of construction.

Will any of our readers answer the latter question?

Makers of Drinking Fountains.

Can you give me the address of the manufacturers who make or can furnish the sanitary drinking fountains such as are now being used in the parks of the principal cities? We want to install them in our village park. Also names of manufacturers of ornamental fountains.

A. B., ——, New York.

There are numerous makers of sanitary drinking fountains. Among those nearest our correspondent are Aird-Don Co., Troy, N. Y., Day-Ward Co., Warren, O., F. N. DuBois & Co., 243 Ninth Ave., Meyer-Sniffen Co., 11 W. 36th St., J. L. Mott Iron Works, 118 5th Ave., New York City, Standard Sanitary Mfg. Co., Pittsburg, Pa. Several of the same manufacturers make ornamental fountains also.

Water Supplies by Compressed Air.

I write you to know if you can give me any information or refer me to any articles on the compressed air system of water works for small towns of 1,000 to 2,000 population. And can you give me the names of towns having this system in use, and also the names of companies who install the system?

C. M. T., ——, Mont.

If the air lift method is referred to, articles on the subject will be found in MUNICIPAL ENGINEERING, vol. xv, p. 240, vol. xxvi, p. 345, vol. xxxi, p. 297, which discuss the principles of the subject; vol. xxix, p. 17, which gives a list of makers of apparatus; and vol. xxii, p. 89, and vol. xxxii, p. 169, which give references to books and articles on the subject. Goodell's "Water Works for Small Cities and Towns" ($2) devotes the most space to the subject of any text book.

If the method of pumping into a tank and depending upon the pressure of the air compressed in the tank to deliver water, thus taking the place of a stand-pipe, the writer knows of no wholly successful plant for a city of the population named. The method is used for small private installations mainly. Such manufacturers as the American Well Works, Aurora, Ill., can give information on this subject. Can our readers report any experience with such plants?

Electrolysis of Underground Structures in American Cities.

We shall be obliged if you will tell us, or advise us where we may learn, what regulations have been adopted in various cities of this country with regard to the electrolysis of gas and water pipes.

STONE & WEBSTER, Boston, Mass.

But little has been done in the way of regulation of electrolysis in this country. A few cities have ordinances and a few have contract provisions and others are operating under agreements resulting from settlements of suits for damages. The following details are at hand:

The city of Mobile, Ala., has an ordinance providing that all electrical companies shall furnish adequate ground return systems in order to prevent electrolysis. A penalty of $50 per day is provided for violation.

Cincinnati has provisions in contracts or franchise ordinances requiring the double trolley system.

Houston, Texas, has a cooperative contract with the traction company, providing for an investigation, and the elimination of all electrolytic troubles.

Cleveland, Ohio, holds the traction company strictly to account on all trouble from electrolysis and enforces a good system of rail bonding and return feeders.

In 1905, Altoona, Pa., sued the traction company for $45,000 for bamages to the water service.

In 1901, the city of St. Paul brought suit against the traction company for damages to water pipes due to defective return circuits. The suit was compromised in 1903 by the traction company agreeing to pay for all pipe damaged in the past and future; and by the further agreement that a more adequate return feeder system would be installed. Tests are made periodically by the city to determine if any electrolytic action is going on.

The regulations in force in England will be found on another page of this number of MUNICIPAL ENGINEERING.

In the following table is given information about the conditions regarding electrolysis in many cities in the United States and the treatment of the matter by the municipal authorities and the various public service corporations interested.

City.	Tests Made.	Rail Bonding.	Return Circuit.	Electrolysis.	Remarks.
Birmingham, Ala.	Irreg.	Good	Fair	Slight	6-in. pipe destroyed in '07.
Mobile	None	Good	Good	None	Ordinance protects city.
Montgomery	None	Good	.....	Slight	
Los Angeles, Cal.	None	.....	.....	Much	Cement pipe joints for insulation.
San Diego	None	Good	Good	None	
San Francisco	None	Good	Good	Slight	
Denver, Col.	*	‡	Good	None	
Bridgeport, Conn.	None	Good	.....	None	Tests in 1906.
Hartford	None	Good	§	Much	Buried return circuit bad.
New Haven	Reg.	Good	Good	Slight	
Wilmington, Del.	.....	Good	‡	None	
Jacksonville, Fla.	.....	.....	.....	None	Dry salt soil.
Key West	.....	.....	.....	None	Dry salt soil.
St. Augustine	.....	.....	.....	None	Dry salt soil.
Tampa	.....	.....	.....	None	Dry salt soil.
Atlanta, Ga.	**	‡	.....	None	
Brunswick	None	.....	.....	None	
Columbus	None	.....	.....	None	
Macon	None	.....	.....	None	
Rome	None	Good	.....	None	
Chicago, Ill.	**	‡‡	Good	None	
Freeport	None	Poor	.....	Much	
Peoria	.....	‡‡‡	None	Much	
Quincy	None	.....	.....	None	
Rockford	None	Good	Good	None	
Springfield	None	Good	Good	None	
Evansville, Ind.	None	.....	.....	Slight	
Indianapolis	None	Good	Good	None	
Richmond	None	Poor	.....	Much	
Davenport, Ia.	None	Good	Good	Slight	
Des Moines	Irreg.	.....	.....	Slight	
Dubuque	None	Good	Good	None	
Kansas City, Kan.	None	Good	.....	Slight	
Louisville, Ky.	***	Good	Good	None	
New Orleans, La.	None	Good	Poor	Much	
Augusta, Me.	None	.....	.....	None	
Portland	None	.....	.....	None	Tests in 1905.
Boston, Mass.	****	Good	Fair	Much	Main under Charles River in particular.
Brockton	None	.....	.....	Slight	
Cambridge	Irreg.	Good	Fair	Slight	
Chelsea	**	.....	.....	Slight.	
Everett	None	.....	.....	Much	
Fall River	**	Good	Good	Slight	
Fitchburg	None	.....	.....	None	
Gloucester	None	Good	Good	None	

City.	Tests Made.	Rail Bonding.	Return Circuit.	Electrolysis.	Remarks.
Haverhill	None	Good	Good	None	
Lynn	None	Good	Good	None	
Marblehead	None	Good	Good	None	
New Bedford	Reg.	.....	.....	Slight	
Salem	None	Good	Good	None	Tests in 1905.
Somerville	None	Good	Good	None	Mains plugged and bonded to rails.
Taunton	**	Fair	.....	Slight	
Duluth, Minn.	Freq.	Good	Good	None	
Minneapolis	Irreg.	Good	Poor	Slight	
St. Paul	Reg.	Good	Good	Slight	City gets damages for all pipe injured.
Grand Rapids, Mich.	None	.....	.....	Much	
Kansas City, Mo.	None	Good	Good	None	
St. Joseph	None	Good	.....	None	
Lincoln, Neb.	None	.....	.....	None	
Omaha	Irreg.	.....	.....	Slight	
Berlin, N. H.	None	.....	.....	None	Tests in 1906.
Manchester	Reg.	Good	Good	None	
Camden, N. J.	Reg.	Good	Good	None	
Elizabeth	***	Good	Good	None	
Binghamton, N. Y.	Irreg.	.....	.....	None	
Buffalo	None	.....	.....	Slight	
New York, B. R. T.	Reg.	Good	Good	None	
New York, N. Y. & Q.	Reg.	Poor	Poor	Much	
Schenectady	None	Good	Good	Slight	
Utica	***	Poor	.....	Much	
Charlotte, N. C.	None	.....	.....	None	
Wilmington	None	.....	.....	None	
Cincinnati, O.	None	.....	§§	None	
Cleveland	**	‡‡‡‡	.....	None	
Dayton	None	Good	Good	None	
Toledo	**	Good	Good	None	
Altoona, Pa.	None	.....	.....	Slight	City sued Ry. Co. for $45,000 in 1905.
Erie	None	Poor	Poor	Much	Pumping machinery damaged.
Harrisburg	None	Good	Good	None	
Lancaster	None	Good	Good	None	
Philadelphia	**	Good	Good	None	
Pittsburg	**	Good	Good	Slight	
Reading	None	Good	Good	None	
Scranton	None	Good	.....	None	
Wilkes-Barre	None	Good	Good	None	
York	Irreg.	.....	.....	Slight	
Newport, R. I.	None	.....	.....	Slight	
Pawtucket	None	Good	Fair	Slight	Tests in 1906.
Columbia, S. C.	None	.....	.....	Much	
Chattanooga, Tenn.	None	.....	.....	Slight	
Memphis	None	Good	Good	None	
Nashville	None	.....	.....	Much	Gas company has sued for damages.
Austin, Tex.	Tel. Co.	Good	Good	Slight	
Beaumont	Irreg.	Fair	Fair	Slight	
Dallas	**	Good	Good	Slight	
El Paso	***	‡	Fair	Slight	
Fort Worth	None	.....	.....	Slight	
Galveston	None	None	None	Slight	Salt soil makes good return.
Houston	***	Good	.....	None	
San Antonio	None	Good	Good	None	Tests in 1906.
Waco	***	Good	.....	None	
Ogden, Utah	None	Good	.....	None	Tests in 1905.
Burlington, Vt.	None	.....	.....	None	
Lynchburg, Va.	**	Good	None	None	
Norfolk	Reg.	Good	.....	None	
Petersburg	None	Good	Good	None	
Roanoke	None	Good	Good	Slight	
Seattle, Wash.	Irreg.	Poor	None	Much	
Tacoma	None	.....	.....	Much	
Wheeling, W. Va.	None	.....	.....	Much	One 20-in. main replaced.
Madison, Wis.	None	‡‡‡‡	None	Slight	Slight trouble '05 caused bond'g.
Milwaukee	None	Good	Good	Slight	Tests in 1903.
Superior	None	‡	None	Slight	

*By water and street railway companies.
**By electrical department.
***By street railway company regularly.
****By city and Water and Sewerage Board.
‡Bonding across and to water mains.
‡‡Rails cast welded and copper bonded.
‡‡‡Double brazed.
‡‡‡‡Electrically welded.
‡‡‡‡‡Near power house.
§Uninsulated ground.
§§Double trolley.

Meter Rates for Water by Gravity System.

Our town is having a struggle over meter rates and we would like to obtain meter rates of places of similar size and location. We have a population of 5,000, and our system is a gravity system, furnished from springs. Could you furnish any statistics or inform us of towns where we could write? I have written to the meter companies, but seem to get very little information from them.

STEIN BANGS, City Engineer,
Rapid City, S. Dak.

It is quite common to base water rates in one municipality upon those in others, but the principle is wrong, for there are always differences in conditions which make such a procedure incorrect and the results inequitable. The only safe way is to determine the actual cost of supplying water, including operation and depreciation, with a liberal allowance for contingencies. Then the quantity of water used should be determined as nearly as possible. If meters are to be introduced into a system already established, a large allowance must be made for reduction in comsumption when meters have been installed. With the total cost and this corrected estimate of consumption the average rate to be charged for water can be computed. Then the distribution of charges to consumer can be made. There is a definite cost of book-keeping, supplying and maintaining meters and reading them which is practically a constant expense, no matter what the amount of water used may be. This is taken care of by making a minimum charge per year or month. Thus in Madison, Wis., (MUNICIPAL ENGINEERING, vol. xxxix, p. 6) the charge is $4 a year for any amount of water used up to 3000 cubic feet. Other considerations cause variations in charges with amount used. Thus, Madison charges 13 cents per 100 cu. ft. for the next 5000 cu. ft. of consumption above the first 3000; 10 cents for the next 15000 cu. ft., and 5 cents for all above 23000 cubic feet used in a year. This method of charging has the authority of successful use. Theoretically the equitable charge is one which includes first the constant minimum charge for each meter in use, and second a constant charge per 100 cu. ft. or per 1000 gal. for all the water used. Practically, questions of business expediency, such as the development of manufacturing industries and other large users of water for the benefit of the city at large or furnishing water for such consumers as cheaply as they can supply their needs by private plants, lead cities to adopt sliding scales, reducing the unit charges as the rate of consumption increases. No water plant can afford on the one hand to ignore the constant minimum cost per tap, and those which have made their charges strictly proportional to water measured are sooner or later obliged to fix a minimum charge. On the other hand no plant can afford to reduce the charge for water for large consumers below the cost of supplying the water. If it is necessary to do this in order to attract an establishment to the town, the special reduction below cost of delivery should be charged to the general revenues of the city and not to the revenues of the water plant. This subject is discussed in several numbers of MUNICIPAL ENGINEERING, for example, in vol. xxxix, p. 18; vol. xxxvii, p. 25. Some further discussion with references to a number of earlier articles will be found in vol. xxxvii, p. 183.

In vol. xxxv, p. 12 is a table showing the averages of rates for water in 375 cities. The average maximum meter rate is given as 26.2 cents per 1000 gallons and the average minimum rate as 9.2 cents per 1000 gallons. The table is from a paper by Dow R. Gwin before the American Water Works Association.

Following are the schedule meter rates in cities supplied by gravity systems, which are listed in Mr. Gwin's tables. A few of those given below also have supplementary pumping plants to use in case of emergency, or for high service districts or fire pressure, etc. The maximum rates, given first, are for the use of small quantities of water and the minimum rates are for the largest quantities named in the respective schedules. All are per 1000 gallons.

Plants under private ownership: Bridgeport, Conn., 20 and 4; Bristol, Conn., (6500 population) 30 and 5; Butte, Mont., 50 and 20; Connellsville, Pa., (7500 population) 27 and 4; Greenville, S. C., 40 and 10; Greenwich, Conn., 29.3 and 16.1; Hagerstown, Md., 30 and 5; Helena, Mont., 40 and 20; Johnstown, Pa., 40 and 5; Little Falls, N. J., (population 4000) 40 and 5; Monessen, Pa., 30 and 8; Morgantown, W. Va., 30 and 10; Norwich, N. Y., (6000 population) 15 and 10; Oakland, Cal., 39.6 and 31.2; Ogden, Utah, 20 and 6; Oneonta, N. Y., (7500 population) 50 and 20; Portland, Me., 26.6 and 9.3; San Francisco, Cal., 33 and 16; Santa Fe, N. M., (6000 population) 30 and 10; Scranton, Pa., 20 and 6; Southbridge, Mass., 30 and 15; Williamsport, Pa., 10 and 5; York, Pa., 2 and 5.8. The average highest rate is 30.7 and the average lowest rate is 11.8, both near 20 per cent greater than the average of all the plants in the tables, given above. The average rates of the smaller cities, whose populations are given above, are 32 and 13.2, still higher.

Plants under municipal ownership: Altoona, Pa., 33 and 4; Amsterdam, N. Y., 21.4 and 4.2; Arlington, Mass., (9000 population) 20 and 13.3; Asheville, N. C., 25 and 8; Athol, Mass., (7500 population) 25 and 5; Baltimore, Md., 20 and 6; Bayonne, N. J., 26.6 and 13.3; Brockton, Mass., 26.6 and 13.3; Clinton, Mass., 33.3 and 8.6; Concord, Mass., (5000 population) 26.6 and 10; Corning, N. Y., 36 and 9; Fitchburg, Mass., 24 and 5.3; Geneva, N. Y., 20 and 6; Hartford, Conn., 16 and 8; Holyoke, Mass., 5.1 and 5.1; Hornell, N.

Y., 24 and 6; Ithaca, N. Y., 31 and 8; Jersey City, N. J., 20 and 10; Kingston, N. Y., 22 and 6.6; Leominster, Mass., 26.6 and 2; Los Angeles, Cal., 9.3 and 9.3; Malden, Mass., 25.3 and 8; Newark, N. J., 15 and 9; New Britain, Conn., 10 and 4; Newburgh, N. Y., 10 and 3; New London, Conn., 16 and 6; New York, N. Y., 13.3 and 13.3; Norwich, Conn., 40 and 5.3; Reading, Pa., 30 and 2.2; Rochester, N. Y., 14 and 14; South Norwalk, Conn., (7000 population) 5 and 5; Springfield, Mass., 29.3 and 6.6; Syracuse, N. Y., 16.6 and 4.6; Waterbury, Conn., 30 and 5; Worcester, Mass., 25 and 10; Washington, D. C., 4 and 4. The average maximum rate is 21.6 and the average minimum rate is 7.2 cents per 1000 gallons, both near 20 per cent less than the average of all the plants in the table, given above. The average rates for the smaller cities whose populations are given above are 19.2 and 8.3.

The average maximum meter rate in the 58 gravity plants named above, without reference to ownership, is 25.2 and the average minimum is 9 cents per 1000 gallons, which are very slightly less than the averages for all the plants in the tables referred to above, without reference to method of supplying water. The average rates for all the smaller cities whose populations are given above are 26.9 and 11.2. The indications are of a tendency to higher rates in the smaller cities.

Information About Water Rates.

If you know where I can procure a directory or other publication giving the rates charged for water in the respective cities and towns of the United States, I shall be obliged if you will kindly give me the title of the publication.

CHARLES MCLEAN, Dubuque, Iowa.

Meter rates for gravity supplies in small cities are given in the answer to another question in this number of MUNICIPAL ENGINEERING. Rates in Connecticut cities are given in the August number, vol. xxxix, p. 121. The latest considerable collection of water rates is in a paper by Dow R. Gwin of Terre Haute, Ind., before the American Water Works Association, which he may be able to furnish. The largest collection of water rates is in the "Manual of American Water Works" ($5), the latest edition of which was issued in 1897.

Charge for Water for Laying Macadam.

We would like to have you give us an estimate as to the cost of water per square foot, for road construction for macadam roads in our city. Our rates for water are 25 cents for a thousand gallons. We should like to arrive at some just basis to be used by contractors doing public work.

LAKE FOREST WATER COMPANY,
Lake Forest, Ill.

Professor Baker in his book on "Roads and Pavements" ($5) estimates the cost of supplying water by hand pumping on highway construction at 2 cents per cubic yard of broken stone placed. If the macadam is laid 6 inches deep, this would make the cost per square foot of macadam surface 0.037 cent. This is apparently equivalent to a rate of about 21 cents per 1000 gallons of water used, so that for a rate of 25 cents the rate per square foot would be nearly 0.044 cent. Depending on the ideas of the engineer regarding the use of water, and the character of the sub-grade, the amount of water may vary from one-third the above amount to four-thirds. Heavy soils, like clay, require the use of the least amount of water possible, while porous sandy or gravelly soils may use the largest amount named. If the thickness of macadam is more than 6 inches the price per square foot should be increased proportionally.

Municipal Light and Water Plants in Illinois and Indiana.

I am an alderman of this city and as some of us favor the establishing of a municipal electric lighting plant in conjunction with our water plant, owned and operated by the city, you would greatly oblige me if you Illinois and Indiana who own their electric light plants, as I would like to investigate the question from a practical and tried standpoint. A. G., ———, Ill.

A list of cities owning both water and electric light plants is given in MUNICIPAL ENGINEERING, vol. xxxvii, p. 257. Aurora and Springfield, Ill., are included in this list. Another list is in preparation and will add Batavia, Bloomington, Downers Grove, Galva, Geneva, Grayville, Louisville, Naperville, Paris, Rantoul, Sandwich, Sullivan, Waterloo, and Western Springs, Ill., and Albion, Attica, Auburn, Butler, Columbia City, Edinburg, Frankton, Garrett, Gas City, Knightstown, Mishawaka, Nappanee, New Castle, North Vernon, Oxford, Rensselaer, Rushville, Summitville, Tell City, Veedersburg, Vevay, Warren, Williamsport, and Winamac, Ind. There are still others in both States which own their electric light plants but not their water plants.

Cost of Laying Water Mains.

Could you let me know where I can find information regarding the cost of laying water mains in small towns of 2,000 inhabitants or less? If you have information directly at hand you might give me cost of laying 6-inch main 5 feet underground, macadam road, clay soil.

G. H. H., Monsey, N. Y.

Data on this subject will be found in many back numbers of MUNICIPAL ENGINEERING. In vol. xxxv, p. 254, is given the cost of laying each size of pipe in Providence, R. I. That for 6-inch pipe is 81.5 cents per foot, counting iron pipe at $36 a ton and not including hydrants.

Books treating the subject more or less fully are Folwell's "Water Supply Engineering" ($3), and Russell's" Public Water Supplies" ($5).

The most accurate method is to compute the cost of trenching and back filling for depth required; pipe laying; and cost of pipe at local prices delivered and thus determine the total cost for the particular conditions. The books referred to give such figures as the following for 6-inch pipe:

Cost of pipe at $30 a ton	$0.68
Cost of excavating and back filling	0.065
Cost of laying including materials.	0.064
Total cost, say	$0.81

Actual cost in Plainfield, N. J., is given as 63.3 cents a foot, and about the same at Alliance, O. This figure does not include replacing pavement, which would add materially to the cost. Probably the latter figure will prove to be the more nearly correct for our correspondent's case.

Cement Manufacture in Mexico.

Are there any cement factories in Mexico other than the three mentioned in the latest edition of the "Directory of American Cement Industries?"

S., New York City.

There are no other factories in operation than the puzzolan factory at Monterrey, Nuevo Leon and the Portland cement factories at Hidalgo, N. L., and Dublan, Hid. There have been reports of a plant operated near Mexico City by Arenzana & Cia, but mail addressed to them is returned undelivered.

Several new plants are in contemplation. The Cementos Hidalgo S. A., operating the plant at Hidalgo, proposes to increase its output. The Compania Bancaria de Obras y Bienes Raices, S. A., which owns the plant at Dublan, is increasing its capacity and proposes to build other plants at various places. Mexico City, Aguas Calientes, Puebla, Durango, Torreon and Morelia being mentioned as possible locations.

There is apparently an independent movement, headed by Cristobal Martinez, to build a plant at Torreon, but this is no further than the "projected" stage.

F. A. Losh, of Santa Clara, Cal., is reported to be considering the construction of a plant near Mexico City. Perhaps this is the same project which has developed to the organization stage as the Toltec Portland Cement Co., an Arizona corporation with an authorized capitalization of $1,000,000, which proposes to build a plant at Tula on the main line of the Mexican railroad, 48 miles from Mexico. The directors are from Kansas, and Louisville, Ky., and F. L. Larabee, Stafford, Kan., is president. The general manager and engineer in charge is reported to be W. E. Burke, Sanza Hotel, Mexico City. Electricity will be the motive power supplied from a hydro-electric power station nearby and oil will be the fuel for burning the cement. The contract for the equipment is said to have been awarded. The capacity of the plant when fully completed is expected to be 1,500 barrels a day, and the machinery proposed includes a crusher, 2 ball mills and 6 tube mills for raw material, 2 kilns and 6 tube mills for the finishing mill.

The International Portland Cement Co. is an Arizona corporation with an authorized capitalization of $2,500,000, which proposes to build a 2,000-barrel plant on its 2,800 acres of property west of Juarez, Mex., opposite El Paso, Tex. The Freeborn Engineering and Construction Co., Kansas City, Mo., is said to have the contract for construction. The offices of the company are stated to be at 1327 Commerce building, Kansas City, Mo. The project seems to be in the "organization" stage.

Kansas City's New Bond Issue.

The bond issue election held in Kansas City resulted in a victory for all the questions under consideration except the Armory, $250,000; the Art Museum, $200,000; the Chase school, $25,000; and the park improvement, $650,000. The items that were voted on favorably were as follows:

For the completion of the market house on the North Side, which will furnish stalls for the gardeners, who daily market their product in Kansas City, and bring about more sanitary conditions and increase the revenue of the city $50,000.

For giving fire protection to ten thousand citizens of the city within the new city limits, who are at present without it, $100,000.

For increasing the capacity and efficiency of the water works in accordance with the plans of George H. Benzenberg, the Milwaukee engineer, who made a careful study of the needs of the system, $1,000,000.

For levees and other improvements for the Missouri river front to get it ready for navigation, $75,000.

For the erection of a house of correction on the city farm at Leeds, $50,000.

For the installation of a city paving plant to enable the immediate repair of holes in the streets and at actual cost, $50,000.

For the establishment of an incinerating plant, $100,000.

For the erection of a tuberculosis hospital, $50,000.

For extending the sewer system of the city, $300,000.

For the Twelfth street traffic way, properly to unite the east and west sides of the city with a traffic way at a grade low enough for heavy traffic, $475,000.

For the building of modern bridges to take the place of old wooden structures that the Board of Public Works cannot condemn now because of the needs of traffic across the Blue river and Brush creek, $200,000.

For the erection of a city hospital for persons afflicted with contagious diseases, $75,000.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

A Serviceable Electric Hoist.

Mr. Nimrod Johnson, superintendent of the municipal lighting plant, of Richmond, Indiana, has an electric hoist that he believes in harnessing to almost any kind of work. At present he has the hoist at work down by the river, about a hundred yards from the power plant. The work consists of dredging the gravel out from around the intake of the plant's pumping engines. About 500 yards of gravel were removed in two days and it was sold for building purposes. The river will in a short time renew this gravel supply and it can again be removed and sold. During the interval of time that the gravel is again filling in around the intake, the hoist will be used to clean out the service well at the plant.

Another use will be found for it at a later date when the coal supply in the bins commences to run low. At present the coal cars are being dumped so that the coal is deposited along the side hill above the plant in anticipation of a shortage this winter. When the bins become empty, the ever-ready hoist will be brought into service to pick up the coal and deliver it into the plant. A picture of the light plant on another page of this number shows the method of delivering coal to the plant.

Central Electric Power and the Smoke Problem.

The importance to densely crowded industrial cities of substituting great central electric power plants for scattered steam plants is suggestively touched upon in a recent paper by Professor Dugald C. Jackson, the newly-elected president of the American Institute of Electrical Engineers, from which the following is taken:

In the city of Philadelphia many tens of thousands of horse-power are used for manufacturing in establishments crowded together in city blocks, and the power is developed in separate large and small power plants located, as physical conditions warrant, in each establishment and with a minimum consideration given to economy. Several (perhaps three) large steam-turbine electric power houses, located on tide water aside from the densely occupied areas and constructed with a careful eye to minimizing the cost of the kilowatt-hour, could profitably supply this power at figures corresponding with its existing cost, and at the same time release for productive purposes large parts of the very valuable space now occupied by individual factory power plants. This would also relieve the thickly occupied parts of the city from the smoke and dirt that have become seriously objectionable, and would also remove the inconveniences now relating to providing the fuel supply and discarding the refuse.

Much is now being said of "city planning." Some of the proposals seem to be founded on pure altruism, but others are obviously founded on economy. The city planners of crowded industrial cities have an opportunity which joins economy with altruism in studying the applicability of electrical power from centralized generating stations to large and small industrial establishments. There is here an opportunity for the betterment of crowded larger industrial cities that ought not to be overlooked. It has its possibilities also in the smaller industrial cities. The possibilities are larger and more real than appear at first view. I lay this before you as one of the most important and desirable ways in which the proved applicability of electrical power to industrial establishments may be utilized for the betterment of crowded factory areas.

Oiling Brick Street.

In connection with the inquiry about the feasibility of oiling a brick street to keep down dust, which was printed in MUNICIPAL ENGINEERING, vol. xxxix, p. 113, the following anonymous report of experience will be of interest. It is taken from *The Improvement Bulletin.*

An Iowa man experimented with laying dust on brick pavement in front of his dwelling, and found that crude oil sprinkled upon the brick served to lay the dust for some time. Much of the oil was absorbed by the brick and the filler,

and served to make the street nearly dustless at that point. The experiment cost about $1.50 for the sixty feet frontage, including the wages of the men who applied the oil. The plans seems to be worthy of being followed up by further and more exhaustive experiments. If it can be shown that the dust can be laid for any length of time by this method, many merchants will be glad to have the paving in front of their places of business oiled, even if they have to bear a portion of the expense.

Pavement Crowns.

To Editor of MUNICIPAL ENGINEERING:

Sir—In a paper prepared on the above subject by the undersigned for the Convention of the American Society of Municipal Improvements held in Little Rock, Ark., in November, 1909, which was published in most of the engineering papers as well as the proceedings of the convention, the general rule was given, for monolithic pavements providing roughened or grainy surface, to provide crown ¼-inch per foot of width of roadway between tracks and that 1-3 of the fall be between crown and quarter and 2-3 between quarter and gutter. A rule in quite common practice is 1 inch crown in 5 or 6 ft. of width and ¼ of the fall between crown and gutter and ¾ between quarter and gutter. The paper gave variations for peculiar conditions such as steep grades, streets having railroad tracks or having curb on one side at a higher level than the other side of the street.

The effect of the rule suggested by the paper referred to as compared with flatter crowns in common practice is:

(a) To slightly raise the crown and consequently provide better flow of water to the gutter.

(b) To increase the ratio of fall from the centre of the roadway to the "quarter" point, thus overcoming the flat crowns holding water and causing deterioration, which is so common in street pavements.

These were the cardinal principles the paper intended to bring out. In discussion following reading of the paper, it was criticised as not providing points between the quarter and gutter and between the quarter and crown. While these "mid-quarter" points are quite unnecessary unless the streets are wider than 40 ft. the criticism of the omission was well taken and the writer replied as it now appears with unsufficient thought as follows:

With reference to suggestion, that my rule did not provide for grades intermediate between the quarter and the crown, or between the quarter and the curb. I must admit that my paper was faulty in that respect. With streets, say forty feet wide, I believe my rule is sufficient and no intermediate points are necessary or advisable. If the streets were of unusual width, the rule I would follow would be to first find the crown, and then find the quarter and intermediate points by highting across with a "T." If the street is of such width that you want intermediate stakes make the same division between the quarter and the curb as between the quarter and the crown; that is, let two-thirds of a total fall be in the half nearest the curb and one-third in the half nearest the crown."

Through private correspondence, Mr. G. B. Zahniser, C. E. of New Castle, Pa., kindly calls my attention to the fact (quite overlooked in my "off-hand" reply to the conditions above referred to) that this provides a "straight line from the crown mid-quarter point to the curb mid-quarter point." Mr. Zahniser agrees with the writer's cardinal rules above referred to, and as to mid-quarter points suggests the following rule, which the writer heartily endorses:

st drop, 1-8 the crown at the crown mid-quarter point.

2nd drop, 1-3 the crown at the quarter point.

3rd drop, 5-8 the crown at the curb mid-quarter point.

The writer's rule, thus modified by Mr. Zahniser, gives the following on a nearly flat street with roadway 80 feet wide between gutters on streets having no tracks:

Crown 20 inches above gutter.

First drop one-eighth of the crown at the crown-mid-quarter point, 2½ inches below the crown.

Second drop one-third the crown at the quarter point, 6 2-3 inches below the crown.

Third drop five-eighths of the crown at the curb-mid-quarter point, 2½ inches below the crown." GEO. C. WARREN,

President Warren Brothers Company,
Boston, Mass.

Action of Bituminous Expansion Joints.

To the Editor of MUNICIPAL ENGINEERING:

Sir: Referring to the article on page 118 of August number of MUNICIPAL ENGINEERING "A Little Bituminous Filler Story."

It occurs to me that the ridge at the expansion joints referred to by Mr. Kingsley may be from another cause than that to which he attributes it. I have never seen transverse expansion joints made by filling several narrow joints with bituminous filler instead of one wide one, but I know that where the wide joint is used, if the bituminous filler is a little cool when poured the top is sometimes filled without properly filling the bottom of the joint, and when expansion takes place the bricks next the expansion joint close in at the bottom, while they are held apart at the top by the filler and accumulation of dirt, causing the brick near the joint to bulge up considerably. It appears to me very probable that where the expansion joint is distributed over

several courses of brick they might rise up in the same manner. I think it probable that if Mr. Kingsley were to take up a section of the brick across the expansion joint he might find this to be the case, and that the brick with the bituminous filler are worn at least as much as those with cement filler.

E. WHITMORE, City Engineer,
Port Huron, Mich.

Expansion Joint in Concrete Pavements.

To the Editor of MUNICIPAL ENGINEERING:

Sir: We are in receipt of MUNICIPAL ENGINEERING, also of "Standard Paving Specifications," and we wish to say that if the specifications of the different pavements are as defective as specifications given in the laying of concrete streets, we are very much afraid that the information in said book will be very misleading, and prove an expensive proposition to contractors who may adhere to its teachings.

One of the most important features in the construction of concrete pavements is to take care of the expansion and contraction of the concrete laid on the street, and in reference to same, it states to fill the joints (made for the above purpose) with creosoted soft wood timber. Who ever heard of timber of any kind that would expand or contract with climatic changes? The idea is a ridiculous one and denotes the absence of thought on that subject. In corroboration of this statement, we wish to say that in one particular instance in the construction of a street of this kind in the city of Fond du Lac, the contractors in charge, by accident, omitted removing the boards, used for the purpose of creating the joint, with the result of having the pavement that came in contact with it, crack and go to pieces.

Our city engineer, Mr. McCullough, who, I believe possesses a superior knowledge relative to concrete construction work, his opinion being sought by the best engineers in the country, will, I believe, fully agree with our ideas in this matter

We note the use of expansion joints between the gutter and pavement running parallel with the same are also omitted. This being an absolute necessity, we would suggest that it be included.

To take care of contraction and expansion seems to be the pulse of the entire situation as to the virtue of concrete pavements, and a little good judgment is necessary.

Contractors are now in a position to make perfect joints of any size by the use of steel expansion wedges, and there is no excuse for extraordinary sized openings, heretofore caused by the use of boards, etc.

Trusting we will be pardoned if we have taken undue exceptions relative to this particular pavement, we beg to remain, Very truly yours,

THE NATIONAL CONSTRUCTION CO.
Per T. E. Dockery, Sec.

The book referred to, "Standard Paving Specifications," contains the specifications adopted by the Organization for Standardizing Paving Specifications at its first convention, held in Chicago in February, 1910. These specifications were provisionally adopted, for many members were not satisfied to be placed on permanent record as endorsing all the details of all the specifications, particularly because it was impossible for every member to examine carefully every specification presented. Several details have been criticised and that referred to in the above letter is, in the editor's opinion, open to the severe criticism given it by our correspondent. Just such criticisms from practical men are desired and any of our readers who wish to add to the number of criticisms are invited to send them in for publication and consideration. The second convention of the organization is called for January, 1911, to meet in New York City, and the eleven months of study which its members will have given the specifications by that time will undoubtedly result in the modification of such provisions as that above quoted.

A long step in advance is made by securing a set of standards vouched for, even though provisionally, by so large a body of the most expert municipal engineers, and when they have matured their judgments by the year of study of the first formulation of specifications, their work will probably be accepted very generally, subject, of course, to such modifications of some details as are required by local conditions.

The American Society of Municipal Improvements, which meets in Erie, Pa., in October, has also taken up the question of standardizing specifications, and is proceeding with greater deliberation. The specifications adopted at the Chicago convention last February and the criticisms thereof, will be open for consideration by that society. Both associations will be greatly aided in their work if engineers generally will express their ideas concerning the provisions already formulated, and will send in such as they feel should be included. MUNICIPAL ENGINEERING has for years advocated the course of procedure now started and wishes to aid in every possible way in promoting the cause. The best method of getting to the provisions that will be generally satisfactory is through public discussion, and the pages of this magazine are open to such discussion in any form which will aid in the advance.

Wide Tires the Remedy.

To the Editor of MUNICIPAL ENGINEERING:

Sir: On page 109 you say: "But heavy travel rapidly turns it (the earth road) to dust; water, beyond light sprinkling, makes mud." Yes indeed! Heavy traffic does make dust and mud of earth roads, and thereby positively precludes any state of ideal perfection.

But why use bad wheels—narrow tires—and so choose to have traffic so scandalously indecently heavy?

I enclose "talk" just published. Please help me to put the bull out of the china shop. If we can't do that, for heaven's sake let's stop talking about the broken china.

Yours for good roads for good wheels,
J. M. HEISKELL, Memphis, Tenn.

The "talk" referred to puts in Mr. Heiskell's unique way the case for wide tires, the substance of which has been printed in this department in communications from him. If all the advocates of good roads were as devoted and as persistent as he, the ideal condition of of roads would be more nearly in sight.

Calcium Chloride for Dust-Laying and Road Maintaining Purposes.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The article and citation in the current issue of MUNICIPAL ENGINEERING on the use of calcium chloride for dust-laying and road maintaining purposes is in the main a very comprehensive and accurate statement of the facts and conditions of the use of this chemical; but you are at fault in two essential particulars. First, in the statement that the chemical will wash and waste seriously; and, second, that it will not wholly dry out.

I have used and experimented with this chemical extensively for the past two years on road treatments, and I think that I have discovered some properties and actions of it that were not heretofore known. To begin with, this chemical, calcium chloride, is virtually a chemical sponge, having the same action as a sponge in absorbing moisture to a complete saturation rapidly and in evaporating slowly to a condition of dryness. Like a sponge, if too freely or too long exposed to a very dry air condition, it will become dry and so cannot and will not give out moisture and therefore will not lay the dust.

A road properly treated with this chemical will not require one-tenth the water which an untreated road will, and the elements, rain, dew and moisture, contained in the air, will supply nine parts of this tenth. On the failure of the elements to give this natural supply, an artificial one must be given or the road will not remain dustless. If this artificial supply is given, the road will remain in a perfect condition at all times. The chemical is practically indestructible, thus insuring a constantly improving roadway with a rapidly decreasing cost. This is the exact opposite of all other forms of road construction and treatment.

Now as to the wash, this chemical is 80 per cent heavier than water, though soluble in it, and so cannot be lifted and made to flow with water. This explains the cause of the thick, syrupy solution so well described in the article referred to above. This syrup is the complete state of saturation of the chemical. It will not take any more water, nor will it wash with the water flowing over and around it. If it is impounded in the roadway, as per my method, it will not move unless pushed by some very strong force. It also has the characteristic of a leech. In the process of saturation it attaches itself to any substance that it comes in contact with and is removed only with very great difficulty. Hence its staying propensities. For example, a long section of hilly road was treated last year at Bloomfield Hills, near Pontiac, Mich. This section of road after it was treated was subjected to seven hard, drenching rains besides numerous lesser ones. It was also covered with snow during several weeks of last winter and spring, but after the snow had melted and the other parts of the roads had dried out this spring, every yard of the treated roadway could be picked out, even to the uneven lines along the border.

In the past two years we did not have a piece of our treated roadway dry out so as to become dusty under two to three weeks, so to be safe in our claims we cut our experiences in half and suggested in our circular the possible necessity of artificial watering once during a week or ten days. During the dry spell we have experienced these past two months we have had newly treated roads dry out and become more dusty in three days than those of last year did in three weeks, and in this same Bloomfield section. This experience has rather called our claims in the circular into question, but we felt when issuing the circular that we were on the safe side when we gave the time limit a margin of 50 per cent.

In the future we shall insist on a wetting of the chemical whenever conditions require it, if the people would have a perfectly dustless condition. To make this possible we are arranging with the Studebaker Bros. Co., of South Bend, Ind., to fit up a small watering cart with pump attachment for use where water under pressure is not obtainable, by which means the sprinkler can be filled from a well, cistern or running stream. We design also bringing out a specially equipped wagon from which a combination of this chemical and the road material can be taken to fill ruts or wheel grooves in the roadway, so that at times when the roads are damp and soft after the rains, a man will go over it with a wagon load of this combination and after having pushed the displacements into the depressions will fill them from the contents of the wagon, tamp same into place,

the chemical in this mixture insuring a perfect knitting and bond with the lower body. In this way you will have a roadway as smooth and even as sheet asphalt pavement without any of the slippery or dusty conditions of the paved street. One man and a horse will care for and keep in perfect condition from ten to fifteen miles of roadway per year. This is an accomplishment which is absolutely impossible with any other form of treatment or construction.

S. G. HOWE, Detroit, Mich.

Municipal Stone Quarry at Two Harbors, Minn.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Replying to the inquiry signed "T. J. W., Milwaukee, Wis.," on page 33, Question Department of MUNICIPAL ENGINEERING for July, 1910, asking in regard to municipal stone quarries and crushers, I wish to say that this city has just completed the erection of a rock crushing plant and opened a quarry in connection with same, and we are now crushing rock which is being used for macadamizing streets in this city.

We have one No. 5 Austin-Western gyratory crusher operated with one 40-horsepower, 1-phase, 60-cycle, 220-volt Wagner motor; a 52-foot elevator and a 14-foot revolving screen, both operated by one 20-horsepower motor of same make and style. Our screen has ⅜, ¾, 1¼ and 2½-inch perforations. We have a spout so that we can either run the rejections back through the crusher by gravity or allow them to go in with the 2½-inch size.

Some items of cost have not yet been booked so that I can not advise definitely as to the total cost of the plant, including motors, transformers, etc., but estimate that it will be approximately $6,000. We have only been operating a little over two weeks so can not furnish information as to the cost per yard for quarrying and crushing.

F. E. EVANS,
President City Council and Purchasing Agent for the City.

Two Harbors, Minn.

Permit for Use of Fire Hydrant by Contractor.

To the Editor of MUNICIPAL ENGINEERING:

Sir: One of the vexing problems which confronts Water Works Superintendents is that concerning the use of public fire hydrants for building and contracting purposes. It often happens that irresponsible persons are allowed by their employers to operate hydrants where water is sold for building and other purposes, and when one of these hydrants is broken through ignorance or perhaps carelessness, the parties responsible for the breakage fail to report same for fear of reprimand or of being charged for the amount of repairs. After experiencing considerable trouble of this character, we think that we have solved the problem by using what may be termed the Contractors' Hydrant Contract, copy of same herewith attached. These contracts are gotten up on the order of a check or requisition book, with each contract and corresponding stub numbered consecutively. We have introduced this plan this year in our own department and it is working to our entire satisfaction. These suggestions may be of use to some who have had this same trouble to contend with.

A. C. GRESSLE,
Supt. City Water Works, Hamilton, O.

No.....

CONTRACTOR'S PERMIT.

This is to certify that....., the holder of this permit, is hereby authorized to use ONE Public Fire Hydrant located at.....St., for a period of.....days. This permit is granted upon the payment of $1.00 to cover cost of inspection. The following conditions must be observed:

Said..... will be wholly responsible, and will pay for any damages resulting from his use of said hydrant.

Contractor also agrees to notify the Hamilton Water Department immediately after through using above named hydrant.

That he will conform strictly to the rules and regulations of the Hamilton City Water Department.

That he will, during his use of said hydrant, keep same in an accessible condition for the City's use, and will never at any time take water from the above hydrant unless meter is used to determine the amount of water used.

This permit is VOID if any other than the above named hydrant is used, and any violation of the above will subject the offender to a penalty of $10.00, to be paid at the office of the Hamilton City Water Works.

WATER WORKS DEPARTMENT.

Per....., Supt.
....., Contractor.

The editor is strongly opposed to the use of fire hydrants for other purposes, believing that special hydrants for commercial purposes, as well as for street and sewer flushing, sprinkling, etc., are much safer and more economical, all things considered. If, however, such uses of fire hydrants seem to be permissible (they are seldom necessary), the above makes it easy to place the responsibility for damage to the hydrant itself. There is an opportunity for dispute as to whether damage developing during a contractor's use of a hydrant results from his use of it, and the use of the phrase "developing during" instead of "resulting from" would prevent any controversies in case a hydrant were used by two or more contractors in succession.

Will our readers report their practice in this regard?

Regulation of Use of Public Baths.

Several inquiries for sets of rules and regulations for the use of public baths have been received. The following, established by the Board of Water Commissioners in the city of Erie, Pa., for the

control of the public free bath illustrated in the August number of MUNICIPAL ENGINEERING are published in accordance therewith:

The cabinets and the swimming pool can be used by the public during week days until 8 o'clock p. m., and on Sundays until 9 o'clock a. m.

Tuesday and Thursday afternoons and evenings will be reserved for women and girls.

All bathers are required to wear bathing suits.

The bathing master will be at the pool from 8 to 12 o'clock a. m. and from 1:30 to 8 p. m. All children must bathe between these hours. Bathing parties consisting of young boys and girls may bathe at any time during the above mentioned hours, if properly chaperoned.

The maximum time in the swimming pool must not exceed forty-five (45) minutes and all unnecessary delay by lingering in and about the cabinets is prohibited.

A quiet and gentlemanly deportment will be insisted upon at all times in and about the swimming pool.

All bathers unable to swim should enter the water at the south end, where it is 2 feet deep, or in the middle, where it is 4½ feet deep, and never at the north end, where the depth is 7 feet.

The use of tobacco, spitting in the water or on the floor, the use of soap in the pool, any injury to the property, scratching or scribbling on the walls are strictly prohibited. Soap must be used in the shower room only.

The water commissioners will not be responsible for any loss of private property in or about the swimming pool.

Persons wishing to learn to swim can make the necessary arrangements with the bathing master.

The space between the cabinets and the pool is to be occupied only by bathers and their attendants.

By order of the commissioners of the water works in the city of Erie.

GEO. C. GENSHEIMER, Secretary.

MUNICIPAL MATTERS IN COURT

Higher Courts—Water Pollution Suit—Chicago Shale Rock Case—Borough Water Contract—Dual Water System—Limit of Indebtedness and Purchase of Water Works.

Decisions of the Higher Courts of Interest to Municipalities.

Eminent Domain — Property Outside Necessary Lines.—St. 1902, c. 534, being an act to provide for the construction of additional tunnels and subways in the city of Boston, by section 6 authorizes the taking by the Boston Transit Commission of lands in fee and easements, including the right to go under the surface or through or under any buildings, and provides that the taking may be confined to a section of a parcel, fixed by horizontal planes of division, below, above or on the surface, when the upper or lower portions need not be taken, except such easements therein as the commission may deem necessary. Section 7 authorizes the commission to sell or remove all buildings from land taken, and to sell, if practicable, and, if not, to lease, any interest taken, whenever it ceases to be needed for such purposes. Held, that the Legislature could provide for the taking of land with a reasonable regard to economy; and since a taking in fee of land outside the limits of the tunnel, which might be seriously injured during the work, might be more economical than the taking of only that which would be used permanently, the Legislature could authorize the taking of such land in fee and the disposal of that part not needed when the work was done, so that the act was not unconstitutional for so authorizing. City of Boston v. Talbot (Mass.), 91 N. E., 1014.

Changing Street Grades—Liability for Damages.—A municipal corporation is liable to the owner of property abutting on a street for changing the grade of the street only so far as damages arise from its doing the work negligently. Harper v. Town of Lenoir (N. C.), 68 S. E., 228.

Changing Street Grades — Supports for Abutting Property.—Where a change of street grade involves an excavation of 12 or 14 feet, leaving abutting property on an embankment of that height nearly perpendicular, and with a soil that will not stand in any such shape, proper care requires the municipal corporation to provide some kind of proper support therefor. —Id.

Change of Street Grade — Measure of Damages.—While the general and better rule of damages for injury to abutting property from negligence of a municipal corporation in making a change of street grade is the impaired market value of the property, the cost of a retaining wall is relevant to the inquiry, and under some

circumstances may be adopted as determinative, particularly where such cost is reasonable, and operates in restriction of amount of recovery.—Id.

Public Improvements — Sufficiency of Specifications for Foundations, Catch-Basins and Curbs.—Committing to the street superintendent's judgment or volition the determination whether, according to the condition of the earth, "crushed rock" or "selected earth material" should be used in the preparation of the foundation for a street improvement, was only a reasonable and necessary discretion to vest in him, since the determination thereof necessitated investigation to ascertain whether the soil was naturally soft or yielding so as to require crushed rock or selected earth material according as to the extent of that quality which it possessed, or whether it was naturally sufficiently compact in itself to require neither of such materials, and a provision in the specifications, giving the superintendent such authority, was not on its face a delegation of an unauthorized power to determine the cost of the improvement, fatal to the assessment. A provision in specifications for a street improvement which minutely describes a catch-basin, both as to size and materials to be used, cannot, in the absence of evidence showing positive injury to have actually resulted therefrom, be held insufficient as delegating power to the street superintendent to fix the cost of the improvement, because it fails definitely to fix the point at which the catch-basin should be located. Specifications for such improvement need not specifically locate the line of the curbs and gutters, it being common knowledge that they must be placed at one of the edges of the street fixed by official survey. Burns v. Corsly et al (Cal.), 109 Pac., 94.

Change of Grade of Streets—Damages and Benefits.—The benefits resulting to abutting property from a change of grade of the street must be considered in connection with the disadvantages resulting therefrom in determining the measure of damages to abutting property. Meardon v. Iowa City (Iowa), 126 N. W., 939.

Water Rates.—A water ordinance providing a fixed scale of minimum charges for water supplied to dwelling houses, based on frontage width up to 50 feet and height up to and including five stories, the rates being increased $1 for each additional story, etc., and being apportioned on the basis of one family to a house and one closet and bath to each house without extra charge, an additional charge being made for each additional family, and providing that all charges not mentioned or fixed are reserved for special contract, did not on its face apply to an apartment house seven stories high, with a frontage of 45 feet. In re Herrman (N. Y.), 123 N. Y. Sup., 752.

Street Improvements — Conformity to Resolution.—A tax bill for macadam 6 inches deep is void where the initial resolution and proceedings had until expiration of the time for remonstrance against the improvement provided for 4 inches. City of Poplar Bluff v. Bacon et ux. (Ark.), 129 S. W., 466.

Special Improvements—Breach of Contract—Right of City to Recover.—A city which has sustained no loss cannot recover on a sewer contractor's bond the excess it is compelled to pay another contractor in special tax bills on the first contractor's failure to perform his contract, regardless of whether it styles itself trustee for the special taxpayers injured. City of St. Louis v. Anderson et al. (Mo.), 129 S. W., 528.

Right to Connect with Sewer.—Where a sewerage company was organized to build a sewer in certain territory and to rent the right to connect with the sewer, and about one-third of it was built on private property, the courts might require the company to permit a landowner to connect with the sewer for a consideration prescribed by the courts. Pulaski Heights Sewerage Co. et al. v. Loughborough (Ark.), 129 S. W., 536.

Assessment District for Street Improvements Must be Entirety.—Inclusion of two district sections of a city, separated at their nearest points by nearly one-half mile, in an assessment district for district street improvements, is not authorized by the local improvement act of February 26, 1901 (St. 1901, c. 38), which authorizes the inclusion of "one or more streets in the same proceeding," such provision applying to improvements constituting an entirety. Southwick et al. v. City of Santa Barbara et al. (Cal.), 109 Pac., 610.

Power to Issue Refunding Bonds.—Under the provisions of section 2315, Rev. Codes, a municipality has the authority to issue refunding bonds for the purpose of redemption of outstanding indebtedness when the same can be done to the profit and benefit of the municipality, and this may be done without the submission of the question of the issuance of such bonds to the electors of the municipality. Veatch v. City of Moscow et al. (Ida.), 109 Pac., 722.

Water Rents—Enforcement of Collection.—Municipal corporations in Ohio are authorized to construct water works and to supply water to their inhabitants, and to collect money for water supplies, and to make such by-laws and regulations as they may deem necessary for the safe, economic and efficient management and protection of the water works. Under this power a regulation providing that, if any party shall refuse or neglect to pay the water rent when due, the water shall be turned off and not turned on again until all back rent and damages shall be paid, and the further sum of $1 for turning on and off the water, is a reasonable regulation and may be enforced. City of Mansfield v. Humphreys Mfg. Co. (Ohio), 92 N. E., 233.

Restraint of Collection of Water Rates

— Determination of Amount Due.—The determination by the proper city officials of the amount due for water supplied is not final, but the consumer who has good grounds for disputing the correctness of the charge made by the city may apply to the courts to determine the amount due and to restrain the enforcement of the rule pending such determination. Id.

Municipal Fire Protection — Effect on Contract — Liability for Fire Loss.—A contract requiring a water company to afford as effective service for fire protection for a city as furnished another only bound the company to use reasonable care to furnish service as near the efficiency of service in the other city as 6-inch pipe would permit, where that dimension was agreed upon in consideration of a reduced hydrant rental, instead of 8-inch pipe, as used in the other city. A water company contracting to furnish water for fire protection is not liable for municipal property burned through the company's failure to furnish an adequate supply, in the absence of an express undertaking to furnish protection to such property. Inhabitants of Milford v. Bangor Ry. & Electric Co. (Me.), 76 Atl., 696.

Public Improvements — Liability for Cost—Setting Curb Under Order.—Provisions of a city charter as to the assessment of damages and special benefits from public improvements, and requiring notice of assessments, have no relation to orders passed under provisions that, if any proprietor shall neglect to curb a sidewalk or gutter when directed by the court of common council, the latter may cause the same to be done, and order it to be paid by the proprietor. City of Meriden v. West Meriden Cemetery Assn. (Conn.), 76 Atl., 515.

Contract—Construction—Extra Work.—Where the plans and specifications for the construction of a bridge for a city, on which bids were invited, recited that the site would be carefully surveyed and marked on the ground for examination by borings made on the center line of the structure as shown on the plans, and that the foundations for the abutments and piers should be carried to solid rock, and the plans showed five borings and indicated the different kinds of soil to be encountered in excavating for foundations as shown by the borings, and upon acceptance of a bid the bidder proceeded with the work and encountered rock which it was necessary to remove which had not been indicated, the bidder was entitled to compensation for the extra expense involved, unless the right to such compensation had been abrogated by the provision of some contract between the parties after the bids were made. Capital City Brick & Pipe Co. v. City of Des Moines (Iowa), 127 N. W., 66.

Acceptance of Contract Price—Extra Work—Settlement of Claim.—Where the liability of a city on the final estimates for the contract price of a bridge could not be in any way affected by a claim for extra compensation, the payment by the city and acceptance by the contractor of the contract price did not amount to any settlement of the claim for additional compensation. Id.

Ordinance Regulating Water Companies —Meters at Company's Expense.—Under Kirby's Dig., secs. 5442, 5445-5447, which give municipal corporations the power to provide and regulate a water supply and authorize the city council to fix reasonable prices to be paid for water, and to require the water company to adopt such rates, an ordinance establishing maximum rates for the use of water, but providing also that in no case was measured water to be furnished at less than a certain sum, and that if the company was dissatisfied with the flat rate it could, after installing and connecting a meter at its expense, require the consumer to pay for measured water at the fixed rates, was valid; the provision permitting the company to install a meter and to require the consumer to pay at the rates fixed for measured water being but a means of regulating the distribution and "supply of water," and of fixing the price that should be paid therefor. Where an ordinance permits a water company, if dissatisfied with the flat rate, to install meters at its own expense and to require consumers to pay for measured water, the consumers cannot be charged with the cost of the meters. Wilson Water & Electric Co. v. City of Arkadelphia et al. (Ark.), 129 S. W., 1094.

Ordinances Regulating Water Companies — Meters at Whose Cost.—Under Acts 1905, p. 700, providing that owners of companies for furnishing water to the general public in cities of the first and second class, if they furnish meters for the purpose of measuring the water in cities of the first class, they shall be furnished upon demand without charge, etc., city councils of cities of the second class are not prohibited from passing ordinances requiring water companies to furnish meters to their patrons at the expense of the companies, nor from passing ordinances requiring patrons of water companies who demand meters to pay for them. Id.

Injunction Against Smelting Company for Water Pollution, is Adjusted.

The injunction suit of Hugh Magone against the Colorado Smelting & Mining Company and others, was decided by Judge Hunt in the federal court, holding that Magone cannot recover for injury done his farm by polluted water, which he, as a subsequent appropriator, voluntarily and with knowledge of the nature of the use by prior appropriators, took out of the Deer Lodge river and spread on his lands by means of ditches. But the court holds that Magone can recover from the defendants for the overflowing of the lands and the settling of debris thereon. Land taken in this way amount-

ed to 39 acres, and the damage is fixed by the court at $572.50.

Under the prayer of the complaint the defendants will be allowed to escape from injunction, provided they pay to the complainant within the next sixty days, the sums estimated by the court as compensation, in lieu of a cessation of the trespass. This alternative decree follows a decision of the Supreme Court of the United States. If the sums are not paid within sixty days, injunction will issue.

Shale Rock Case Fails at Chicago.

M. H. McGovern, the contractor indicted on charges of grafting from the city in the "shale rock" scandal, was cleared when Judge Barnes refused to allow his case to go to the jury. Judge Barnes had already taken the cases of Paul Redieske, former deputy commissioner of public works, and John Ericson, city engineer, who were indicted on the same charges, from the jury. The state announced it would non-suit the case against Ralph A. Bonnell, former assistant city engineer, but the defense objected, and Judge Barnes instructed the jury to find him not guilty.

New Jersey Borough Water Contract Void.

In the certiorari proceedings brought in the Supreme Court by John A. Bayliss and others against the mayor and council of North Arlington and the mayor and aldermen of Jersey City, N. J., to review a resolution and contract of North Arlington, whereby it attempted to obtain a water supply from Jersey City, Justice Trenchard filed an opinion in the court, setting aside the resolution and contract with costs. The prosecutors of the suit contended that neither North Arlington nor Jersey City had legal authority to make such a contract.

Justice Trenchard states in the opinion that the only authority to execute such a contract is in the State laws, which provide that it shall be lawful for the governing body of any municipal corporation to make contracts "with any adjoining corporation" to supply it with water.

In the present case it appeared that North Arlington is about five miles from Jersey City. The opinion holds that the laws referred to give such rights only to municipalities whose corporate territories are contiguous.

Effect of Limitation of Indebtedness on Municipal Acquisition of Water Works.

Judge Endlich of the Common Pleas Court of Berks county has rendered a decision regarding the acquisition of the plant of the Fleetwood Water Company by the borough of Fleetwood which shows the action of the laws of Pennsylvania in such cases. Under the act of 1907, the borough had petitioned the court for the appointment of appraisers for the plant, an appraisement was made and the company objected to the continuance of the proceedings on the ground that the indebtedness of the borough resulting from the transaction would exceed its constitutional limitation. The court cites sections 5 and 6 of the act, P. L. 355, 1907, which provide that the payment for the water works shall be out of a sinking fund derived from the revenues of the plant only, thus not increasing the general indebtedness of the city. The constitutionality of the act as applied in the case is discussed and affirmed and the proceedings for completing the transfer are permitted to continue.

Quincy Favors Commission Form of Government.

At a meeting held in Quincy, Illinois, on July 29, a movement was started to place that city among those having the commission form of government. The movement was started by the Chamber of Commerce and is not in the slightest degree partisan.

Briefly the commission form of government is that of a city conducted by a commission, consisting of a mayor and four commissioners to take the place of the city council, as has been the form in the past. Under the law of this State the referendum, initiative and the recall features are carried in the law. The mayor and commissioners serve in office for four years, with the mayor drawing a salary of $3,600 per year or less, and the commissioners drawing a salary of $3,000 or less. The mayor is to be made what is known as the superintendent of public affairs, and at the first meeting of the commission after election the members of the commission agree among themselves which one will have charge of the following other departments — one commissioner to be in charge of the department of public accounts and be superintendent thereof, one to be in charge of the department of public health and be superintendent thereof, one to be in charge of the department of public improvements and be superintendent thereof, and one to be in charge of the board of public property and to be superintendent thereof. The park and school systems do not fall under the jurisdiction of the commission.

Cement Exports and Imports.

The importations of foreign cement has declined from 1,509,047 barrels in the year ending June 30, 1908, to 506,151 barrels for the corresponding year in 1909 and 429,215 in 1910. At the same time exports have increased from 945,421 barrels in 1908 through 827,971 in 1909 to 1,715,169 in 1910. The greatest reduction in imports was in English cement, but this was in part offset by a material increase in the importations from Canada.

WATER AND LIGHT

Dual Water System in Ft. Worth—Concrete Water Tank—Electrolysis Legislation—Leakage in Tunnels—Sterilization of Water —Minimum Charge for Gas

Fort Worth Adopts Dual Water System.

Fort Worth, Tex., has just completed the installation of a dual water system. The old system consisted of a chain of artesian wells, from which the water was pumped for all purposes. There was an emergency intake at the Trinity river for use in case of need, but the artesian water only was used, except in the case of an unusually large fire. The new system consists of a separate line of mains drawing their supply from the Trinity river. These mains are laid only in the business district and are connected to fire hydrants, water troughs and public fountains and later all hotels, public buildings, garages, livery stables and other large consumers will be expected to use the water for flushing purposes.

A rate of 10 cents per million gallons has been adopted with a view to determining the rate to be charged later. Consumers are not required to sign a contract for a longer period than 90 days, until a permanent rate is determined. By the 10-cent rate, if it proves feasible, Fort Worth compares favorably with the larger cities of the East and it is probable no other city in the South or Southwest has as low a rate. So large will be the capacity of the system that it was realized at the first estimate that much more water would be pumped through this system than would be used by the fire department, and the connections with private consumers were decided upon as a means of reducing the expenses of operating the system.

A Circular Reinforced Concrete Water Tank.

Mr. H. F. Blomquist, city engineer of New Ulm, Minn., describes the method of constructing and waterproofing a 1,000,000 gallon circular water tank constructed in that city. The tank was 75 feet in diameter and 30 feet high, and is covered with a conical concrete roof.

As the soil where the tank was constructed was of a hard clay, the base of the tank was placed upon it in the following manner: Upon the excavation made for the base was spread a 12-inch layer of stone, upon which was poured a wet, fine-grained concrete. This floor was reinforced with expanded metal of No. 16 gauge thickness and 3-inch mesh. The floor is bonded to the walls by 1-inch steel rods placed at 12-inch intervals throughout the circumference and bent so as to be imbedded 4 feet in the floor and 4 feet in the wall.

The walls are 20 inches thick at the bottom and taper to 15 inches at the top, with the batter on the outside. They are reinforced with 123 1⅛-inch and 40 1-inch round steel rods rolled to the required radius and placed horizontally, and by 20 upright supports made of steel angles with lacing bars, which served as supports for the horizontal rods during the time of construction, as well as vertical reinforcement in the walls. The horizontal reinforcement is sufficient to take all the stress without assuming tension in the concrete, or counting on the support of the earth embankment on the outside.

The roof is a conical slab of concrete 3 inches thick and reinforced with No. 12 gauge, 3-inch mesh, expanded metal, and it is supported by eight steel trusses radiating from the wall to a center pillar.

Especial care was taken to secure a waterproof tank. All material was carefully graded and smooth pebbles were used in the place of broken stone, as it was believed that broken stone tended to cause voids. In bonding old to new work the old surface was carefully cleaned and a neat cement grout was poured on before the new material was applied. To reduce the permeability to a minimum, 20 pounds of hydrated lime was used to every barrel of cement. After completion the walls were brushed clean with steel brushes and a cement plastering was applied, consisting of one part of cement, two parts of sand, 10 per cent of hydrated lime and 3 per cent of Medusa waterproofing compound.

No leaking has been reported since the reservoir was completed with the exception of a small, unimportant leakage in the floor due to an imperfect bond between some new and old material.

British Legislation Relative to Electrolysis.

In Great Britain all power of granting franchises is vested in Parliament and all laws affecting public service corporations are made by Parliament. In connection with the granting of franchises and rights the government enforces certain rules which have to do with the proper operation of the companies' privileges. Electric franchises contain certain rules relative to electrolysis which are in effect as follows:

1. The electrical power shall be used only in accordance with the Board of Works regulations, and in such regulations provision shall be made for preventing fusion or injurious electrolytic

action of or on gas or water pipes or other metallic pipes, structures or substances and for minimizing as far as is reasonably practicable injurious interference with electric lines and apparatus of other parties, whether such lines do or do not use the earth as a return.

2. When the return is partly or entirely uninsulated, a continuous record shall be kept by the company of the difference of potential during the working of the railway between points on the uninsulated return. If at any time such difference of potential between any two points exceeds the limit of 7 volts, the company shall take immediate steps to reduce it below that limit.

3. Provision is made for an adequate system of rail bonding and return feeder circuits to be maintained. Further provision is made that if any uninsulated return rail is within 3 feet of an uninsulated conductor, it shall be bonded to the conductor at distances apart not to exceed 100 feet.

4. A penalty of 10 pounds is provided for each offense against the provisions of the act and a further penalty of 5 pounds for each day during which the provisions of the act are ignored after notification of trouble.

The Prevention of Leakage in Pressure Tunnels.

In the construction of the great Catskill water supply system for New York City a great many types of aqueduct are necessary to conduct the water. In those parts of the line where it is necessary that the water shall be conducted under pressure, the problem is especially difficult. For such sections there were three forms of construction available, namely, steel pipe, reinforced concrete pipe and pressure tunnel construction. The construction of the latter type, with the methods to be used to prevent leakage into and out of the tunnel, is especially well covered in a paper by Mr. Thomas H. Wiggins before the Municipal Engineers of the City of New York.

It is recommended in all cases where pressure tunnels are constructed, that the weight of rock above the tunnel shall be such as to more than equal the internal upward pressure which will be developed, even if the latter spread out indefinitely sufficient time for purification. This as-undiminished. The circular shape was adopted at the outset for pressure tunnels because of the external pressure which the tunnel may be called upon to carry when under construction or out of service. This external pressure is due to ground water and is dependent upon the relative porosity of the rock and the concrete. The process of grouting is intended to overcome some of this external pressure as well as to guard against inward or outward leakage. At the same time the grouting will serve to stop leaks which might otherwise relieve the unequal pressure. It was to overcome the porosity and external cracks in the rock as well as to afford a means of equalizing the pressure that the system later described was adopted. The tunnel lining was designed to withstand the whole ground water head, and the grouting is to be forced in between the lining and the outer rock. As Mr. Wiggins states it, he prefers to think of the lining "as a smooth coating to produce a high coefficient of flow and a bulkhead serving temporarily to retain the grout and enable it to be forced into the voids in the rock, the rock being thereafter the main water stop."

The problem of grouting is identified with taking care of the incoming water during concreting. All such water must be kept from the fresh concrete and carried through the forms in pipes. These pipes afterwards serve to conduct the grout to be forced through and back of the tunnel lining. The grout serves to fill the voids around and over the arch, but in the case of dry, impervious rock surrounding, the grout may be omitted without serious loss, if suitable sweepers are constructed to equalize the pressure on the inside and outside of the lining. The filling of crevices and holes in the rock through which ground water enters is of great importance, since water can escape wherever it can enter and in much greater quantities, because the unbalanced heads are much greater.

In grouting, cut-off walls are established every 50 feet, in all types of tunnel, extending from the lining to the roof. These walls prevent the grout from following its own whim in spreading to other parts of the tunnel rather than filling the interstices as intended. It is the intention to grout each leak through an individual pipe, so that each leak requires one connection direct to the surface of the form for the grout pipe and another to a collector set in the lining and communicating with the interior through weepers. Vent pipes must be provided for the air which is forced out by the introduction of the grout.

There are two types of machines for forcing the grout into place. One type consists of a tank which weighs only 500 pounds when empty, but is designed to stand 600 pounds test pressure. The grout is mixed in this tank by admitting air at the bottom, so that there are no revolving parts to become worn out through use. The grout is forced out by admitting air under pressure at the top of the tank and opening a 2-inch valve at the bottom. The second type machine is for use in forcing grout into porous lining, and is called the "pad grouting machine." It consists of 15x20-inch steel casting, flat and with the center dished. Around the central hollowed portion is a rubber gasket to permit of the grout being held in place when the casting is forced against.

the surface to be treated. The casting is mounted on a hollow steel column which may be raised by means of two jacks that work against a cast iron bearing base. Both machines were designed by Mr. W. L. Cariff, who had charge of the grouting of the Cincinnati tunnel.

The Sterilization of Water.

The question of the sterilization of water is one which is occupying a great deal of time and attention of public officials. In New York in particular, where the great Catskill water supply system is being worked out, is the question being thoroughly discussed. Mr. Nicholas S. Hill, in a paper before the municipal engineers of the City of New York, takes up the matter in its different phases. His paper is too long for presentation here, but some of its features will be discussed.

The physical properties of water which affect its attractiveness are color, odor, turbidity, taste and hardness. The removal of pollution increases the attractiveness by the removal of the color, odor and turbidity and sometimes the taste and hardness. Microscopic organisms are sometimes responsible for odors and tastes which are not necessarily injurious. Only chemical, bacteriological and microscopical examinations of the water will serve to decide if it is really injurious to health.

The purification of the water supply, in addition to precautionary measures with regard to sewage discharge into the source of water supply, requires some means of removal of danger due to isolated infection, such as that from discharge from farms along the source of supply. The method recommended is by means of filters. The filters described are of the two types, the slow filter and the rapid or mechanical filters. In the former the water passes down by gravity through beds of sand of certain depth and is restricted as to velocity. In this case the suspended water, including most of the bacteria, is retained upon the surface of the sand, while a portion of the organic matter in the water is converted by chemical action into inorganic compounds. The process of rapid sand filtration consists in passing water downward at a rapid rate through small beds of sand, a certain amount of coagulating material having first been introduced into the water to assist in catching and holding the bacteria and suspended matter. This coagulating agent is usually sulphate of alumina. The rapid filter with its chemical action is said to bring about a higher chemical purification than the ordinary slow filter. The cost of filtration varies from $6 to $11 per million gallons including operating cost and fixed charges. On a basis of 70 gal. per capita per day for domestic uses, this would amount to only $0.281 per capita per year.

Another method of purification consists in allowing the water to stand in a reservoir or sedimentation tank to allow the natural process of purification to act. It is important in such a reservoir that the water should have a free circulation, in order that the water may not simply flow from inlet to outlet without allowing suring of thorough circulation will lessen the chance of plant growth along the sides and bottom of the reservoir.

The two processes, filtration and natural purification, should be supplemental and co-ordinate. When it is absolutely necessary to use the stored surface supply system alone, proper care should be exercised to prevent isolated nuisances. The reservoir site should include strips of land surrounding the basin and such land should be graded with a view to preventing danger from small communities, farming sections or initerant population.

The charcoal means of water purification, when the sole means employed, is not to be encouraged. The chemical method though cheap is effective only as a disinfectant. The method employed usually consists of adding chloride of lime or hypochlorite of sodium. There is some controversy as to whether the oxygen liberated from the hypochlorous acid or chlorine is the active disinfecting agent. These questions, however, are not pertinent, as the purifying effect is present and is recognized. The process is in the experimental stage and as yet it is not known if the amount of hypochlorous acid or free chlorine present in the water as delivered, may be sufficiently high to cause inhibitive action in digestion in the human stomach. On the other hand, so small a quantity of chemical as to remove all chance of danger to the human digestion would have little or no effect on the pollutions in the water. Water treated chemically should be stored so as to allow of the natural removal of free chlorine. The cost of the use of chlorine in purification plants is not known, but it costs between 75c and $1 per million gallons of effluent coming from septic tanks and sprinkling filter sewage purifiers.

The application of chemicals advisedly and with a proper consideration of their real functions will mark a great advancement in the purification of public water supplies, but they should be used in connection with chemical precipitation and sedimentation or filtration.

Determining Minimum Charge for Gas.

The Railroad Commission of Wisconsin in connection with the petitions of the Green Bay Gas and Electric Company for authority to increase rates, has used a very thorough method of analyzing the matter of minimum meter rate for gas. The company complained of the annual loss due to the large number of customers whose bills were 10, 15 and 25 cents per month. The company felt that it was an

unjust burden to be compelled to maintain meters and make installations in such cases. The company submitted an analysis of cost which is here reproduced. The analysis is made on the basis of a 5-light meter at $7.25 meter cost and $4 service investment.

TABLE I.

AVERAGE COST PER METER.

Resulting From or Attendant Upon the Maintenance of Meters Upon Consumers' Premises.

General and office expenses	$1.630
Registering and collecting	.187
Consumers' premises expenses	.389
Meter repairs and connections	.362
Service expenses	.295
Miscellaneous	.071
Bad accounts	.041
Taxes	.711
Depreciation (5 per cent on $7.25 per meter)	.362
Legal expenses	.072
Interest (6 per cent on meters and services)	.675
	$4.765
Interest (gas department's proportion of 5 per cent bonds issued)	4.900
Total cost per meter per year	$9.665

The company showed by an itemized table of customers' expenses that while the consumers were only assessed $5 for a service connection, the cost of installation was $9, and that the cost of the meter was $7.25. On the basis of this table it was shown that the amount which should be covered by minimum charge would be about $3.65 per annum or 30 cents per customer per month.

It would appear from this that the minimum charge should be 30 cents per month, but this charge would fail to cover the cost of any of the gas actually delivered to the consumer. The general practice is to levy a minimum charge that is high enough to cover the consumers' cost as well as the cost of the gas that is used by the smallest unit or meter in service. The question was, therefore, to determine the amount of gas that should be covered by such a minimum charge. The basis for such a determination was a table, given below, which shows by months the number of small consumers and gross revenues derived from them in 1909.

From this table it is seen that the average income per meter per month is 22.4 cents, taking those meters registering from nothing to 59 cents. Following the same plan the average of those meters consuming less than 40 cents' worth, was about 10 cents per month.

In view of the above facts the company was authorized to add to its rate schedules a minimum charge of not more than 40 cents per month where only one meter is used, and of not more than 25 cents per meter per month where two meters are used, one each for light and heat.

Washington's River Park Plans.

Plans for the improvement of Potomac Park east of the Pennsylvania railroad embankment and the deepening of the Washington channel of the Potomac river opposite Washington, D. C., have been prepared by Lieut. Col. W. C. Langfitt, Corps of Engineers, and approved by Gen. Bixby, chief of engineers. They are based on the appropriation of $180,000 for the improvement of the Potomac river contained in the river and harbor act approved June 25, 1910.

The present project for this general improvement was adopted August 2, 1882. Its object is the improvement of the navigation of the river by widening and deepening its channels, the reclamation of the flats by depositing on them the material dredged from the channels, the periodic flushing of the Washington channel and the establishment of harbor lines.

In the execution of this project there have been obtained by dredging, channels from 400 to 550 feet wide and 20 to 21 feet deep, through the bars in the Virginia channel and the Washington channel. The ruling depth is now 19 feet at mean low tide in Virginia and 21 feet in the Washington channel.

The tidal reservoir has been dredged and redredged to 8 feet, the present pre-

Month.	Total customers.	Total meters.	Meters not registering.	0 to 9 cts. meters.	10 cts. to 19 cts. meters.	20 cts. to 29 cts. meters.	30 cts. to 39 cts. meters.	40 cts. to 49 cts. meters.	50 cts. to 59 cts. meters.	Total gas consumed, cu. ft.	Per customer, cu. ft.	Per meter, cu. ft.	Total revenue.	Revenue per consumer.	Rev. per meter.
January	1,029	1,121	291	Included in meters not registering.	184	226	127	154	139	2N.600	205.6	188.7	$244 62	$0.238	$0.218
February	1,071	1,175	457		6	227	140	174	171	227,000	211.9	195.0	270 56	.252	.231
March	986	1,108	406		2	219	126	177	178	214,900	218.0	193.9	246 62	.250	.222
April	1,015	1,173	395		6	234	105	223	210	239,800	236.3	204.5	261 83	.258	.223
May	1,084	1,227	408		19	242	93	252	222	262,000	241.8	213.5	304 84	.280	.248
June	1,141	1,241	501		12	274	61	236	157	202,000	177.0	162.7	258 14	.226	.208
July	1,126	1,187	531		12	303	41	197	113	182,300	161.9	153.5	219 10	.194	.184
August	1,067	1,145	469		9	248	45	219	155	197,600	185.0	172.5	259 44	.243	.226
September	926	1,004	379		6	189	58	197	175	196,900	212.7	196.0	242 62	.262	.241
October	916	995	319		13	189	104	176	194	223,800	244.3	225.0	245 04	.267	.246
November	951	1,009	357		14	181	119	168	170	217,300	228.5	215.0	252 72	.267	.251
December	1,089	1,183	422		21	243	126	179	192	215,300	198.6	182.0	240 94	.221	.203
Total	12,401	13,568	4,935	....	304	2,775	1,145	2,352	2,076	2,590,600	.....	.....	$3,046 47	.....	.....
Average	1,033	1,132	411	....	25	231	95	193	173	215 883	210.1	191.8	$253 87	$0.216	$0.221

vailing depth. The reservoir outlet and inlet gates have been completed. A training dike, 5,965 feet in length, has been constructed in the Virginia channel above the Long bridge. About 35,541 linear feet of sea wall have been constructed around the reclaimed area.

The flats, by the river and harbor act of March 3, 1897, were declared to be a public park under the name of Potomac Park. That section lying westward of the railroad embankment, containing 300 acres of land and 111 acres of inclosed water area, has been filled to the full projected grade. It has been turned over to the office of public buildings and grounds, and developed by the latter office as a public park.

According to Col. Langfitt the work required to complete the existing project is dredging in the Washington channel, raising that section of Potomac Park (comprising 328 acres of land) lying eastward of the railroad embankment to the projected grade, relaying a portion of the masonry sea wall and the completion of the training dike. He says that maintenance work will be required from time to time in the removal of freshet accretions from the Virginia channel, but that no such work will be required in the tidal reservoir or the Washington channel above Arsenal Point, as the curtain gates at the inlet to the reservoir will be lowered to prevent freshet flow and sedimentation.

Adding an unexpended balance from previous appropriations there is now $186,000 available for the continuation of the improvement. Col. Langfitt says that money will be expended, beginning within the next three months, according to the following schedule:

Reclaiming that portion of Potomac Park lying eastward of the railroad embankment to the full projected grade by dredging in the Washington channel to the amount of 1,500,000 cubic yards, $143,000; repairing and relaying sea walls, $26,000; watchman, care of property, maintenance of outlet and inlet gates, etc., $2,000; contingencies, engineering, etc., $15,000.

SEWAGE AND REFUSE

Sewage in Fish Pond—Paris Garbage Disposal—Waterproofing Concrete Sewers—San Francisco Garbage Disposal—Vincennes Sewers

A Fish Pond Fed by Sewage Effluent.

Last year a pond constructed at Litchfield, England, was stocked with roach and perch, which appear to thrive in spite of the fact that the only water supplied is effluent from the city sewage works. The sewage contains a large proportion of trade waste and is treated on the septic system, with the addition of chemical precipitation at times when the raw material is very foul. The final effluent passes through a series of open troughs and is discharged into a small brook.

Regarding the fish pond, Mr. Chancellor, the city engineer, recently stated that while it may be admitted that fish will sometimes live in water of inferior quality not sufficiently good to be taken as a standard of purification in the case of sewage effluents, yet it is a distinct advantage to have a pond stocked with fish and be able to say when complaints are made about cattle being affected by the water that the fish are thriving.—*Ferro-Concrete.*

Garbage Disposal in Paris.

In Paris household refuse is set out in front of houses during the night in tin, zinc or galvanized iron cans or boxes, whence it is collected in the early morning hours by large wagons belonging to the municipality. For this service an ordinary family living in a flat pays a tax of about $11 per year. The wagons carry the rubbish to quays along the river Seine, where it is dumped through chutes to barges. Both while in the boxes along the streets and on the quay the refuse is worked over by chiffoniers, or rag pickers, who sort out and take away rags, paper and other articles, from the sale of which a large number of men, women and children gain a living in Paris.

There are several private establishments in the neighborhood of Paris for the salvage of bottles, glass, crockery, tin cans, bones, etc., but by far the most important of them is at Bondy, about eight miles east of Paris, on the Canal de l'Ourcq, which connects with the Seine. The establishment is owned and operated by a private company which was organized and took up the business after the government of Paris had failed in its attempt to destroy the city garbage by burning. The refuse landed at the wharves in Bondy is carefully picked over, and all rags, bones, old paper, tin cans, metal, glass, oyster shells, etc., which have escaped the hook of the chiffonier are taken out and assorted for separate treatment. The cans are cut up for tin, which is used in making toys, for which large quantities of this scrap tin

are sent to Germany. The rough bones are used as material for glue, the finer ones for making knife handles, buttons, dominoes, dice and other articles. Oyster shells, which are rich in lime and phosphates, are ground into powder, which is mixed with grain and other materials to make food for poultry. The remainder of the rubbish, which consists mainly of ashes and vegetable refuse, is pulverized and sold to farmers as a fertilizer. Owing to its percentage of potash it is too strong to be used alone; it is therefore mixed with barnyard manure.

The Effect of Waterproofing Compounds in the Permeability and Tensile Strength of Concrete.

The report of the commissioners of sewerage of Louisville, Ky., contains an account of an interesting series of experiments along the lines of permeability and tensile strength of waterproofed concrete.

The method used for determining the permeability of different concretes was similar to that employed in the Government laboratory for testing structural materials located at St. Louis. Specimens of concrete were made 10 inches in diameter and 4 inches thick. These blocks were placed between iron castings bolted firmly together in such a way as to allow the application of water under different pressures to a surface 6 inches in diameter. In order to provide water at definite pressure, an airtight iron tank containing filtered water was connected with another tank containing compressed air. The pressure was communicated from the air tank to the surface of the water in the other tank, from which pipes properly controlled by valves conducted water to the specimen.

These tests were made upon concrete, the constituent parts of which were so proportioned as to form a theoretically

TABLE I

Duration of Seepage Test, Seven Hours

Specimen	Cubic inches per sq. inch.	Cubic centimeters per sq. centimeter.	Gallons per sq. foot.	Total seepage in cu. centimeters.
Perfect mixture	1.53	3.99	3.22	7.21
Concrete (1:2:4)	6.30	16.6	13.85	310.00
Concrete with				
Clay 5 per cent	0.85	2.20	1.78	398.00
Clay 10 per cent	0.12	0.31	0.25	56.00
Concrete with				
Firesand 5 per cent	4.86	12.65	10.21	22.90
Firesand 10 per cent	1.20	3.12	2.51	565.00
Concrete with				
Hydrated lime 4 per cent	0.71	1.83	1.48	332.00
Hydrated lime 6 per cent	0.24	0.62	0.50	112.00
Hydrated lime 8 per cent	0.10	0.27	0.22	49.00
Concrete with				
Medusa 2 per cent	0.92	2.49	2.01	450.00
Medusa 4 per cent	0.0	0.0	0.0	0.0
Concrete with				
Maumee 4 per cent	0.23	0.61	0.49	110.00
Concrete with				
McCormick	0.17	0.44	0.36	80.00
Concrete with				
Ceresit	1.98	5.03	4.22	928.00
Concrete with				
Toxement 4 per cent	0.0	0.0	0.0	0.00

TABLE II.

Waterproofing Materials Used	How Added	Per Cent Used	Tensile Strength			
			Neat		Mortar 1-3	
			7 Days	28 Days	7 Days	28 Days
McCormick "A" from St. Louis	Combined at the mill		797	740	205	307
McCormick "B" local	Combined at the mill		513	577	199	220
Ceresite	In place of water	5	642	669	311	375
Molding sand	Used for sand	5	698	743	176	368
Molding sand	Used for sand	10	636	642	177	510
Hydrated lime	Added directly	5	749	651	387	511
Hydrated lime	To dry cement	10	608	635	371	505
Clay	In place of sand	2-5	753	737	235	344
Clay	In place of sand	5-0	718	912	221	401
Clay	In place of sand	7-5	644	802	344	327

perfectly graded mixture: Concrete, 1 part cement, 2 parts Ohio river sand, and 4 parts Ohio river gravel, 1:2:4, to which various commercial waterproofing compounds were added, and concrete in which a portion of the Ohio river sand was replaced by an equal portion of very fine sand and clay. Where hydrated lime, Medusa, Maumee and Toxement were used the amount added was a definite proportion of the quantity of cement used and the quantity of cement used was not reduced. The McCormick compound was mixed at the time of grinding, and the Ceresit was added to a portion of the water used in a proportion of 1 to 20.

Table I shows the results of the permeability tests. Further tests showed that the quantity of seepage was approximately proportional to the pressure applied and that there was no apparent cessation after an application of pressure for eighteen hours.

Table II shows the results of tests to determine the effect of waterproofing materials upon the tensile strength of neat and mortar (1:3) briquettes.

Specifications for New Incinerating Plants for San Francisco.

The department of public works of the city and county of San Francisco, Cal., has recently published specifications for the construction of two incinerating plants for disposing of the garbage of the city which contain some interesting provisions. The specifications were prepared by the city engineer, Marsden Manson, and Rudolph Hering was the consulting engineer. Ten pages of the book are devoted to statistics regarding the garbage and refuse collected in the city and their characteristics. Each plant is to have a capacity of 120 tons of mixed refuse per day of 24 hours, without additional fuel and to be reduced to a thoroughly hard burnt residue, innocuous and free from organic matter. The average temperature of combustion must be 1500 degrees and the minimum 1250 degrees. The general features of the apparatus are described. The bids are to state the total cost of construction complete in all details; the guaranteed net cost of incineration of the standard garbage (containing 1000 pounds of water and 460 pounds of combustible per ton in the furnaces); the decrease and increase in the net cost per ton for each pound excess or deficiency of combustible; the decrease or increase in net cost per ton for each pound increase or decrease in water per ton of combustible; the number of guaranteed pounds of standard garbage consumed per square foot of grate area for final combustion; the probable gross rate of evaporation in the boilers per pound of standard garbage. The lowest bidder will be determined by comparing sums obtained by adding 10 per cent of each total bid for construction of plant as fixed charges, to 40,000 times its guaranteed annual operating cost per ton of refuse.

Specifications for all parts of the plant are very complete, and the description of the method of test is more than usually detailed. Bonuses and forfeitures are provided for in case the cost of incineration is found by the tests to be less or greater than the bid or guaranteed cost, determined by multiplying the difference between the actual and guaranteed costs by the probable tonnage of refuse destroyed in three years, estimated at 120,000 tons at each plant, and provided that the difference shall not exceed 8 cents in either direction.

Municipal Construction of Sewers in Vincennes.

As it has been found unpopular to build sanitary sewerage systems in Vincennes by the plan of assessing each piece of real estate, the Board of Public Works has passed resolutions recommending that the council appropriate $100,000 to build the main trunk lines, reducing plant and pumping station. The council is in thorough accord with this plan and likely will make the necessary appropriation. After the trunk lines are built it is proposed to extend the sewers by districts.

Popular Form of Graft.

The man who tried to kill Mayor Gaynor of New York is not an anarchist, although some newspapers have so described him. He is a grafter of the type common in all big cities—the man who thinks he has done some work in politics for which the city owes him a living. The hardest strain the honest and courageous administrator of city affairs has to face comes from the friends of useless hangers-on, who, whenever it is proposed to cut off sinecures, raise a general chorus of "Aw, let the poor fellow alone; he needs the money! Give him a chance!" Gaynor has been striving to put the New York City government on a business basis, which meant cutting off the heads of hundreds of Tammany men who regarded their jobs as personal assets. If Gaynor should die, of which there is happily now but little danger, a new election might restore Tammany to power—so this fellow and his associates figured, and they seem to have talked the matter over in cold blood. The man who is giving honest measure of work for the wages he gets rarely has to worry about keeping his job. We sacrificed one President to the spoils doctrine, and Chicago lost a mayor by assassination from the same cause, and now the life of one of the best mayors New York ever had—for so Judge Gaynor has turned out—is in jeopardy. Civil Service has difficulties and drawbacks, but it is a thousand times better than this sort of thing.—*Pacific Outlook.*

CURRENT INFORMATION

Bloomington Paving—Chicago Paving Contract Losses—Wood Block in Berlin—National Highways—Milwaukee Municipal Reference Library—Town Planning in England

Bloomington, Ind., Starts Street Paving.

Martinsville and Bloomfield brick manufacturers were awarded the contracts by Bloomington, Ind., to furnish more than 1,000,000 brick for the first street paving to be done in the city. George T. Miller, of Lebanon, who has the contract to pave Walnut and Sixth streets, will use Bloomfield brick, and C. M. Kirkpatrick, of Kokomo, who is to pave College and Kirkwood avenues, will use the Martinsville product.

Loss in Chicago Paving Contracts.

The Merriam Commission reported to the Chicago city council on August 5th regarding the operations of Contractor McGovern whereby he received excessive compensation from the city in certain paving contracts made in 1908 and 1909. McGovern, it will be remembered, is the contractor indicted for the "shale rock" fraud on the Chicago sewer work, and cleared when the case came to trial.

In its report on the paving contracts which the city gave to McGovern in 1908 and 1909 the Merriam Commission deals with the 1-cent bid made by McGovern and declares he was paid $413,247.64 for work which should have been done for $266,064.54..

The acceptance of this unbalanced bid, and the extension of the contract to about eight times the quantity of work named in the original schedule resulted in the loss to the city of a large sum of money. The contractor was paid $413,247, while, if the proposal of the Western Construction and Maintenance Company, which was the next lowest to the McGovern bid, had been accepted, the amount paid for the same work would have been only $266,064. In other words, the city would have saved $147,183 on the contract.

Comparison of cost of the work done under the McGovern contract with what it would have been at the prices of other bidders shows:

Item.	Amount.	Contract Prices. Unit.	Contract Prices. Total.	Other Bidders. Unit.	Other Bidders. Total.
Repairs, class A, square yards...	229,891	$1.75	$402,309.25	$1.04	$239,006.64
Repairs, class B, square yards...	12,064	.01	120.64	1.40	16,889.60
Cement concrete, cubic yards....	643	3.25	2,089.75	5.00	3,215.00
Binder delivered, tons.....	2,182	4.00	8,728.00	3.15	6,873.30
Total			$413,247.64		$266,064.54

The report in explaining the 1-cent bid points out that work referred to as "Class A" consisted of resurfacing, while work referred to as "Class B" consisted of putting in concrete and binder as well as resurfacing. McGovern bid $1.75 a square yard on the ordinary resurfacing work and bid 1 cent a square yard for putting in concrete and binder and doing the resurfacing.

Wood Block Pavement Favored in Berlin.

For automobile traffic in cities, pavements made of impregnated wooden blocks are said to be the best, according to a report to the bureau of manufactures by A. M. Thackera, American consul general at Berlin. He says they do not wear out automobile tires so quickly, are freer from dust and more susceptible to the influence of dust-binding and dust-settling agents.

Asphalt, however, he adds, is still considered the best all-round pavement for heavy traffic. Experiments in tarring roads to keep down dust, he reports, are being made in various parts of Germany.

Town Planning in England.

The subject of beautifying sections of cities and cities and towns as wholes seems to be even more popular in England than in this country, and the Department of Civic Design of the School of Architecture at the University of Liverpool issues a quarterly *Town Planning Review,* which is a handsomely printed and illustrated magazine of value to everyone interested in this work. It costs only $2.50 a year and the two numbers already received are evidence of the ability and public spirit of the editors and publishers.

National Highways Planned.

At the closing session of the National Good Roads Congress, held in Niagara Falls, N. Y., Representative Sulzer's suggestion for the construction by the State and separate counties of the State of a highway connecting Buffalo, Niagara Falls and New York City, was enthusiastically adopted. The resolutions adopted call for the construction of permanent highways from the national capital to

each state capital, the expense to be borne by money loaned to the states, as set forth in the Sulzer bill, which will be reintroduced in Congress at the next session.

Another resolution adopted called on all organizations, trade, educational, industrial, farmers, producers and consumers, to instruct their legislators to introduce bills for and to fight for better roads throughout the country.

Milwaukee's Municipal Reference Library.

The city of Milwaukee has created a department known as the Municipal Reference Library. The aim and purpose of this department is to make a thorough investigation of all municipal problems now pending, or as they may arise; to anticipate future legislation; to collect, compile, classify and index the charters, laws, ordinances, etc., of cities; to gather data, reports and statistics obtainable from such cities; to collect facts from magazines, newspapers and reports of organizations working along the lines of municipal reform and civic betterment.

This department intends to co-operate with other cities along the lines above mentioned; soliciting the interchange of municipal reports, charters and ordinances and offering, without charge, similar reports, etc., relative to the city of Milwaukee.

MUNICIPAL AND TECHNICAL LITERATURE

Ptitsburg Transportation Problem—Municipal Reports—Books for Engineers

Preliminary Report on Pittsburg Transportation.

Mr. Bion J. Arnold, consulting engineer, has made a preliminary report to the city of Pittsburg relative to the solution of the transportation problem in that city. The question of a subway as a means of meeting the difficulty is discussed in this report and certain lines of inquiry are mapped out with a view to determining the possibility of that solution.

In connection with his report Mr. Arnold offers some suggestions regarding the better routing of the surface cars to insure a more efficient service. At present he says the entire routing system is out of balance. A more complete record system for schedules, delay and accident reports is strongly urged; and a fixed fund for the improvement of service conditions is recommended. These points are most strongly advocated as a means towards relieving the traffic congestion in the downtown district.

Municipal Reports.

Joint Outlet Sewer for eleven separate municipalities in Essex and Union counties, New Jersey. A history and description of an accomplishment by voluntary joint effort. Edition of 1910. By Alexander Potter, C. E., New York City.

This report embodies all the matter that appeared in the edition of 1905, and contains considerable new matter. Among this new matter is a synopsis of the joint sewer laws, under which the joint trunk sewer was constructed and is being maintained. This was written by Mr. Adrian Riker, counsel for the joint meeting since its inception. It is of interest to note that the Passaic Valley Trunk Sewer Commission, which has been commanding a great deal of attention during the last few years, has formulated its laws after the laws governing the joint trunk sewer. This is interesting because agitation for the Passaic Valley sewer was started a number of years before the joint trunk sewer was even thought of, and the fact that the sewer which forms the subject of this report has been in successful operation for the last five years, is a tribute to the wisdom and zeal of those public-spirited men who gave their time and attention to the consummation of this important enterprise.

Another important matter dealt with in this report is that of sewer leakage, the experience of five years of maintenance clearly indicating that in a reasonably well constructed sewer the element of leakage is a progressively diminishing factor. Continuous gaugings of the flow in the sewer at numerous points give abundant testimony as to the truth of the assertion.

Another matter dealt with in the report is a discussion in connection with odors arising from sewers where house traps have been inserted between the sewer and the house vents throughout districts where it has been necessary to close up the perforations in the manhole covers.

The report contains full information as to costs and apportionments of cost. It is also fully illustrated with details of construction and photographs showing the progress of the work, and also contains a map of the district sewered, upon which are delineated the system of main trunk sewers and the laterals connected therewith.

The plan of apportioning the cost of the sewer was suggested by Mr. Alexander Potter and was based upon the capacity which it was assumed each municipality required, and the length of sewer necessary to serve each of the municipalities; or, in other words, the apportionment of cost was based upon the assumption of each town designing its own sewer outlet to a common point and each municipality sharing the cost of such joint sewers as could be used by it in the ratio of their respective capacities in the portions utilized by them. The maintenance, on the other hand, has been apportioned equally between all users, on the basis that, being a gravity system, the town contributing the largest volume to the sewer required no greater service than the town contributing a lesser amount. The experience of the last five years indicates that the flow from the larger towns requires less attention and maintenance than the flow from the smaller towns.

The men most active in bringing this project to a successful completion were Mr. Francis Speir, Jr., Adrian Riker and Alexander Potter, C. E., and it is interesting to note that these three have retained their connection with the joint trunk sewer from its inception to the present time in the respective capacities of chairman of the joint meeting, counsel, and chief engineer.

The towns and cities served by the joint trunk sewer are: Elizabeth, Roselle Park, Irvington, Vailsburgh, a small part of Newark, South Orange, West Orange, Millburn, Summit, and the townships of South Orange and Union.

Books for Engineers.

Bricklaying System. By Frank B. Gilbreth, M. Am. Soc. C. E. 321 pp. Cloth, $3. The Myron C. Clark Publishing Co., Chicago, Ill.

This book is the first attempt to put modern brick laying methods in form for general use, and as the author is an eminently successful engineering contractor who is a skilled observer and organizer, he has prepared a most useful and practical book. It bears the marks of being largely a compilation of instructions to men engaged upon work under the author's care, which have thus been thoroughly tested in practice.

The object of the book is stated to be the recording of the traditional methods of bricklaying, the formulation of labor and cost saving methods of doing the work which at the same time increases the pay of first-class workmen, so that the apprentice may begin his work intelligently and become proficient in as short a time as possible. The book will also be of great value to the foreman, the superintendent, the contractor, the architect and the engineer, even more than to the apprentice.

The titles to the chapters show the scope of the work. The first on "Training Apprentices" is largely a series of brief instructions to the learner. That on "Methods of Management" is largely addressed to the foreman. That on "Methods of Construction" appeals to the superintendent, as do those on "Routing of Materials," "Scaffolds," "Gilbreth Scaffold, Hod Type," "Gilbreth Scaffold, Packet Type," and "The Gilbreth Packet System." "Tall Chimneys," "Mortar," Bricks," are for contractor, superintendent and foreman. "Bricklayers' Tools" comes back to the apprentice and shows how to use the common and the modern tools. So do the chapters on "Lines, Plumbs and Poles," "Motion Study," "Methods of Laying Brick Under Special Conditions," "Finishing, Jointing and Pointing," "Arches and Chimney Breasts," "Tearing Down, Cutting Out and Patching Brickwork," from which the expert bricklayer can also derive much benefit. The chapter on "Bond" and the seventy-three bond charts are also of great value to the architect and engineer. The book ends with a glossary of the terms used.

The author gives some valuable advice to brick masons regarding the improvement of quality and reduction in price of brickwork, without reducing the pay of the workmen, by using modern methods and management, so that brick work will not be crowded out of the field by the cheaper and often more flexible modern material, concrete, plain or reinforced. The attitude of many brick masons' unions toward concrete is deplored and if they will follow the author's advice it will result in benefit to both the brick and the concrete trades.

Sanitary Engineering, a practical treatise on the collection, removal and final disposal of sewage and house refuse and the design and construction of works of drainage and sewerage, with numerous hydraulic tables, formulae and memoranda, including an extensive series of tables of velocity and discharge of pipes and sewers. By Col. E. C. S. Moore, R. E. Third edition revised and in part re-written by E. J. Silcock, M. Inst. C. E. In two volumes. Vol. I, Sewerage, Hydraulics, Sewer and Drain Ventilation, Sanitary Fittings and Apparatus, pp. 1-500. Vol. II; Land Drainage, Sanitary Notes, Sewage Disposal, Refuse Destructors, Trade Effluents and Sewage Fungus, pp. 501-880. With 920 illustrations, 91 large folding plates. Cloth. $14 net. J. B. Lippincott Company. Philadelphia, Pa.

This book, then in one volume, was carefully reviewed some seven years ago in MUNICIPAL ENGINEERING. The third edition has been materially improved and

brought down to date, particularly in the sections devoted to sewage disposal and refuse destruction, in which fields there has been much advancement made in the past ten years. The book is a report of English practice, under English conditions, but is for the American nevertheless the best book on the subject of sanitary engineering which there is on the market. It fully takes the place for modern practice of the classic Latham, so long the standard.

Owing to the death of Col. Moore, the new edition is revised by E. J. Silcock, the president of the Society of Engineers, who has followed the same lines of treatment and has largely re-written the second volume, on sewage and refuse disposal.

In the first volume there have been numerous additions of new material, including odorless excavators, fuller discussions of the various systems of sewerage, of rainfall and methods of carrying it off, sewage lifting with examples of installations, concrete, plain and reinforced, in

In the first volume there have been numerous additions of new material, including odorless excavators, fuller discussions of the various system of sewerage, of rainfall and methods of carrying it off, sewage lifting and examples of installations, concrete, plain and reinforced in sewer construction, sewer joints and appurtenances, what is styled the new egg-shaped sewer form, with tables of capacities, the triangular notch sewer ventilation, and triangular notch sewer, ventilation, and

The second volume gives descriptions of the best installations of all the various reasonably successful methods of purifying sewage, destroying refuse and disinfecting materials and habitations and is nearly all either new or newly arranged and brought down to date, so that this volume contains the best that can be found on these subjects so far as English practice is concerned. This list of new materials in the books covers all the sanitary engineering construction and design in which notable advances have been made, and is evidence that the book gives equally good treatment of the standardized practice in this field, which is corroborated by the earlier review above referred to. Every American as well as English sanitary engineer should have this third edition, whether he has the earlier editions or not.

How to Use Concrete. A book of practical information not found elsewhere about the uses of concrete. Written in plain English for the practical man. Compiled by Walter C. Boynton and R. Marshall. Cloth, 233 pp., $1. Concrete Publishing Co., Detroit, Mich.

The editor of this book has not seen the contradiction on the title page between the statements that the book is a compilation and that the information is not found elsewhere. Like many books written in plain English for practical men, this book omits many important details in processes. Whether this is due to the strong tendency of the practical man to omit the things which he is so accustomed to that they do not impress him as essentials, or whether it is due to the attempt of the office man with no factory experience to devise methods for the mechanic to follow, will be easily seen by the reader.

Warning is given that artistic results can not be obtained without artistic training, but the warning is discounted by reference to occasional good results from beginners in such work.

The book is certainly a compilation and from many sources, good and indifferent and positively bad so far as the ornamental features are concerned. Haste in compilation is shown by the mass of unrelated statements under the division beginning on page 163 under the heading "Portland Cement Production," which contains data and statements concerning all phases of cement and concrete materials and uses, apparently taken from a superficially edited question department without taking the trouble to check one statement by another and with no attempt to classify the data given.

It is such books as this which lead to the failures in strength of concrete structures and to the crude and positively ugly attempts at ornamental work in cement and concrete, which delay the progress in the general public opinion which concrete demonstrates that it deserves when used by technical and artistic experts.

Bruecken in Eisenbeton; ein Leitfaden fuer Schule und Praxis. Second part, arches. By C. Kersten. Paper, 198 pp., 5.20 marks; cloth, 6 marks. Wilhelm Ernst & Sohn, Berlin, Germany.

The first chapter takes up many details peculiar to reinforced concrete in bridges, showing approved forms. The subsequent chapters classify the details and methods of construction under single-span arches, solid and ribbed, with rods and bars, with trussed reinforcement, with and without hinges, trussed concrete arches, subways and conduits, and arched roofs. There is also a well-illustrated chapter on centers for concrete arch construction. The book is conveniently arranged and unusually full of detail for so brief a treatment of a large subject and should be very satisfactory for those who can read German.

The Everyday Uses of Portland Cement. Boards, 156 pp. The Associated Portland Cement Manufacturers (1900) Ltd., Portland House, London, E. C., England.

This book, which is distributed in England without charge to those interested in the use of cement, is intended to furnish the "lay user of Portland cement, i. e., the farmer, estate owner, manufacturer and householder," with some account of the many uses to which they can put cement and concrete and some idea of how the materials are handled in making the constructions described. It is written in simple language, "plain English for the prac-

tical man," but it is written by experts in the handling of cement and concrete, who have done their work carefully and with an absorbing interest in their work.

The material in the book is well selected and well arranged and the reader, when he has read the interesting connected story, will feel that he knows something about the subject, at the same time that he will believe that the actual manipulation should be intrusted to practical hands. The book is well illustrated, printed on good paper and neatly bound.

While the publishers may not be willing to distribute the book free outside their own field, it can perhaps be obtained by paying the cost of production and delivery, possibly 50 to 75 cents.

The Engineering Index Annual for 1909. Twenty-sixth year. Cloth, 471 pp., $2. The Engineering Magazine, New York.

This is the fourth of the annual volumes, the previous years being included in four preceding volumes, and is compiled in the same form as those of the last three years. The civil engineering field is not covered very satisfactorily, and occupies only 95 pages. Electrical engineering covers still less, 63 pages; industrial economy has 16 pages, marine and naval engineering 23 pages, while mechanical engineering has 132 pages, mining and metallurgy 86 pages, and railway engineering and street and electric railways together have 56 pages.

The method of classification is not always happy and it is necessary to look in several places for all the information on a subject. Thus articles on explosives are listed on pp. 178, 335 and 393, under Marine and Naval Engineering, Mining and Metallurgy, and Mining. Explosions has still other locations. This arises from the fact that the subject of explosives is important in each of these divisions, although it would seem that the two under mining classifications might be united into one. There should be some way for one who is looking up the general subject of explosives to find all the headings without looking through all the general divisions of the index. There are many other headings of the same sort.

The gathering of monthly indexes into an annual volume is a convenience.

Die Grundzuege des Modernen Krankenhausbaues. By Max Setz, Architect. Cloth, 204 pp., 120 cuts and several tables, 3.80 marks. Druckerei- und Verlags-Aktiengesellschaft vorm. R. v. Waldheim, Jos. Eberle & Co., Vienna, Austria-Hungary.

This little book gives an excellent general view of the principles of design of hospitals for various purposes and is well illustrated with many plans of buildings, photographs of rooms, drawings of apparatus and details, etc. It seems to cover all the modern improvements of every sort and should be exceedingly interesting to those in whose field it belongs.

Municipal Franchises. A description of the terms and conditions upon which private corporations enjoy special privileges in the streets of American cities. By Delos F. Wilcox, Ph. D., Chief of the Bureau of Franchises of the Public Service Commission for the First District of New York. In two volumes, of which the first is now published. Cloth, 710 pp., $5. The Gervaise Press, Rochester, N. Y. Engineering News Book Co., New York, distributing sales agents.

The author is in position to become thoroughly familiar with franchise questions and this first volume of his book demonstrates that he has taken full advantage of his opportunities and that he is more than willing to share the results of his most intelligent labor with his fellow citizens.

The complete book will include four parts, two of which are contained in this first volume. Part I is introductory and discusses in judicial language "How Franchises Get Away," "What a Franchise Signifies," "Monopoly Profits and Ways of Limiting Them," "Injuries to Individuals and Ways of Preventing Them," "Temptations to Public Wrong and Ways of Overcoming Them." The second part gives in sufficient detail and in good English, shorn of confusing legal terminology, the provisions of many franchises in cities of various sizes providing for the operation of systems of public service using pipes and wires. The third part will give a similar analysis and discussion of transportation franchises of all kinds, and the fourth part will discuss the taxation and control of municipal franchises, and will, apparently, express the author's opinion more fully than is possible in those parts devoted to the statement of what has already been done in the formulation of franchises.

Part II includes electric light, heat and power, telephone, telegraph, messenger and signal services, conduits, water works, sewers, central heating and refrigeration, pneumatic tubes, oil pipe lines, artificial and natural gas. Examples of franchises are taken from many cities, such as Birmingham, Los Angeles, San Francisco, Denver, New Britain, New Haven, Washington, Atlanta, Boise, Rockford, Chicago, Springfield, Indianapolis, South Bend, Des Moines, Cedar Rapids, Topeka, Wichita, Newport, New Orleans, Baltimore, Boston, Worcester, Springfield, Somerville, Saginaw, Grand Rapids, Ann Arbor, Detroit, Kalamazoo, Duluth, Minneapolis, St. Paul, St. Louis, Kansas City, Butte, Jersey City, Newark, Trenton, Long Branch, Atlantic City, Buffalo, New York, Troy, Rochester, Syracuse, Lockport, Cleveland, Cincinnati, Columbus, Toledo, Portland, Philadelphia, Erie, Harrisburg, Lancaster, Johnstown, Nashville, Knoxville, Austin, Salt Lake City, Richmond, Seattle, Wheeling, Milwaukee, La Crosse.

The present volume gives many pointers on how not to build a franchise, but many more on the details which it is advisable to include in a franchise, so that one who

studies the book carefully will be able to cover all the points which any one has found worth formulating under the conditions which have existed heretofore.

The author has had and will have excellent opportunity by virtue of his official connections to improve the conditions of cities, especially in his own State, as regards the terms of franchises for municipal public service industries, and it is to be expected that he will consider in full detail in his fourth part numerous features which have been proposed and many of which have been adopted and give promise of bettering the conditions on both sides, by letting in the light. Many of these problems have been quite thoroughly discussed in MUNICIPAL ENGINEERING from time to time. Naturally only a few phases of the problems are considered from the new standpoints of equity and publicity in the introductory chapters of the present volume, and his treatment of others in the next volume is awaited with interest in view of the excellent work the author has done thus far.

ORGANIZATIONS AND INDIVIDUALS

League of American Municipalities—Technical Schools—Technical Organizations—Civil Service Examinations—Henry Mueller—Personal Notes

The League of American Municipalities.

The fourteenth annual convention of the League of American Municipalities was held in St. Paul, August 23 to 26. MUNICIPAL ENGINEERING goes to press too early to receive a full report of the meeting, but the following account of the earlier days, by an editorial correspondent, covers most of the points of interest to our readers.

President Heineman called the convention to order at 10 a. m., August 23, in the St. Paul auditorium. Hon. H. P. Keller, mayor of St. Paul, delivered the address of welcome, and in his remarks he called attention to the need of better city government. In the response to this address President Heineman remarked upon the business ability required in city affairs and upon the fact that the league was an aid to the betterment of business conditions. President Heineman also paid tribute to the memory of Governor Johnson, of Minnesota. Attention was called to the development of tubercular hospitals and the need of a unified movement in that direction. The president also urged the adoption of measures leading to the establishment of a central library for the collection and exchange of city documents.

A letter was read from President W. H. Taft, declining the invitation to attend the convention and conveying his approval and best wishes for the league and its work. The treasurer's report was then read, and a paper by Dr. P. M. Hall, commissioner of health of Minneapolis, completed the morning's business.

In Dr. Hall's paper the matter of garbage collection and disposal was treated, taking for an example the city of Minneapolis. In this system the garbage is divided into two classes and a can is provided for each class. The division is into combustible material, such as kitchen garbage, refuse, etc., and incombustible material, as ashes, glass and tin cans. According to the rules of the Health Department, all moisture must be drained from the material of the first class and it must be carefully drained and wrapped in paper before being placed in the can. This does away with the frozen garbage can in winter or the "foul, maggoty mess" in the summer; in addition to prolonging the life of the can. Under this system collection once a week is often enough to avoid nuisance, and the drivers of garbage wagons have orders to pass by and report all cans which do not meet the Health Board requirements. The system has been successful, for where formerly about thirty complaints per day were turned in regarding unsanitary garbage cans, a complaint is now a rarity. In conclusion, Dr. Hall called attention to their garbage incinerator, which, in burning the garbage, furnishes heat, light and power for the city workhouse, the superintendent's house, two greenhouses and the Hopewell Tubercular Hospital. The fact that the latter institution was located near the crematory, three years after the crematory had been constructed, is a tribute to the absence of all nuisance about the garbage handling and incineration.

In the remarks following Dr. Hall's paper the mayor of Baltimore told of that city's plant, where the garbage is hauled fourteen miles, the grease and ash

are utilized and where the garbage is sorted before incineration. Mayor Behrman, of New Orleans, in commenting on Dr. Hall's paper, called attention to New Orleans' garbage disposal. It was formerly the custom to haul all garbage to receiving stations on the Mississippi, where it was dumped into barges and hauled out to sea. At present all garbage is dumped into swamps lying about New Orleans, with the double purpose of filling the swamps and killing the mosquitoes. The mayor of East St. Louis asked why Dr. Hall did not give some costs of disposal. In reply Dr. Hall stated that costs were a matter of local conditions, and that they should, under any condition, be subservient to sanitary considerations.

At the opening of the afternoon session of the league, Mr. A. H. Griffith, director of the Detroit Museum of Art, read a paper recommending that more attention be paid by municipalities to art and its advancement.

After this paper was read a resolution was unanimously adopted condemning the attempted assassination of Mayor Gaynor, of New York, and expressing the sympathy and good wishes of the convention.

Mayor Behrman, of New Orleans, then read a paper on "The Street Paving Problem." He commented on New Orleans' slowness with regard to her paved streets and offered in explanation the fact that New Orleans first had to solve the levee problem for self-protection, and the sewage and water problem for sanitation, before even considering the paving problem. Asphalt is the most popular paving material and brick the least popular in New Orleans. Provision is made in each contract for the maintenance of all repairs for a period of years. The city retains 15 cents per square yard of the contract price of the pavement as a sort of insurance of the fulfillment of the contract. The city owns its own asphalt repair plant and takes care of all its asphalt pavements, repairs being made in all cases before a break in the surface appears. Mr. Behrman's paper contains some valuable statistics, and will be published soon.

Mr. Frank T. Fowler was absent, and his paper on "Street Paving from a Maintenance Standpoint" was not read.

Mr. E. C. Schreiter, clerk of the common council of Detroit, next read a paper dealing with Detroit's paving affairs. The state law permits Detroit to do $500,000 worth of forced paving per year, without the consent of the property owners. The property owners pay all costs of paving except subdrainage and intersections, assessment being made on the front foot basis. All repairs, intersections and repaving are paid from the general fund. The city owns her own asphalt resurfacing plant and does resurfacing at a cost of from 86 to 98 cents. This plant has a capacity of 1,800 square yards, and was built at an original cost of $55,600. All contract work is paid for by bills issued by the city engineer's office. These bills, upon recording, constitute a prior claim on any piece of property, and property may not be sold until it is shown that paving assessments, etc., have been discharged.

Following Mr. Schreiter's paper, the convention adjourned to enjoy a sightseeing automobile trip over the excellent paved streets and oiled roads of St. Paul.

At the Thursday morning session the auditing committee reported the treasurer's books in good order; the report was accepted.

Mr. Blair, secretary of the National Paving Brick Manufacturers' Association, read a paper on the proper construction of brick pavements. In his paper Mr. Blair endeavored to meet the seeming lack of interest in brick pavements in some sections. He brought out the fact that poor brick pavements are not entirely due to the quality of brick used; in fact, the manner of laying influences the durability and practicability of brick streets. Mr. Blair said that when brick streets were properly constructed they were beautiful, smooth, sanitary, gave a minimum amount of noise, and possessed a low tractive resistance. The points he set forth in the proper construction of brick streets were: First, have the sub-grade carefully prepared, drained and brought to the required grade; second, place the concrete foundation on this sub-grade, taking care to bring it to smooth surface; third, spread upon this smooth surface a sand cushion of never less than 2 inches of fine sand; fourth, place the brick with the best surface uppermost and roll with a roller not exceeding five tons in weight (never a horse roller); fifth, use a good cement filler, with expansion joints allowed along the curb. Mr. Blair dwelt at some length on the latter point, stating that no soft filler would insure the bricks against cracking and chipping.

In the discussion following Mr. Blair's paper several interesting points were brought out. It was stated that the size of the brick made no difference in the pavement, beyond the fact that a brick larger in its least dimension than 3½ or 4 inches was seldom well burned. In reply to a complaint from a Moline delegate, stating that their pavements were noisy, having raised from the foundation by reason of expansion, Mr. Blair replied that if careful side expansion joints were allowed and competent men were employed to see that the joints were made after the filler was applied and were properly filled with the right material, this trouble would not occur. A No. 6 pitch was recommended for the more northern regions like St. Paul and Minneapolis, while for regions farther south a good asphaltic filler was advised to fill the expansion joints. In reply to a question, Mr. Blair characterized Kansas City's brick streets as "bum," due to lack of care in laying, and not due to the brick. It was stated that square or round cor-

nered bricks are equally good, and that the round corners did not cause little fins of the cement filler, which cracked off. As a proof of this, Mr. Blair stated that on the Indianapolis Speedway these little projections of cement tended to wear out the automobile tires. In order to remove them they tried drags of stone and other materials, wearing out the drags, but leaving the projections. It was finally necessary to use a corundum drag to smooth them down. Only a slight crown was advised, and any system of laying consistent with beauty was recommended, the laying having no effect on the wearing quality.

Following Mr. Blair's paper, Mr. F. R. McDonald, superintendent of Minneapolis city workhouse, read a very interesting and instructive paper on the psychological side of city reformatory work as typified in the workhouse. Mr. McDonald dwelt at length on the advisability of furnishing out-of-door employment either on farms, brickyards, stone quarries or gravel pits, for the most efficient means of correcting the criminal tendencies of the short-term prisoners.

An address by Hon. John H. Gundlach, president of the council, of St. Louis, Mo., on the city's control of outlying districts, concluded the official program for the day.

The delegates were entertained during the afternoon by the Associated Playgrounds of the city.

On Wednesday the convention was the guest of Minneapolis, and visited the parks, public buildings, city workhouse and crematory. At the late afternoon session, held in Music Pavilion Hall, the government of cities by commission was discussed. This will be considered later.

The Friday program included discussions of "Home Rule for Cities," by J. Barry Mahool, mayor of Baltimore, James C. Dahlman, mayor of Omaha, Neb., and Thos. Maloney, mayor of Council Bluffs, Ia.; "Simplified City Government," by S. A. Carlson, mayor of Jamestown, N. Y.; "The Relation of the Municipality to Its Public Service Companies," by J. C. Haynes, mayor of Minneapolis, and a general discussion of what cities are doing and in what they excel.

A municipal parade was witnessed at 3:30.

Officers elected are D. A. Brown, pres., Kansas City, Mo.; R. A. Maddox, Atlanta, Ga., and T. E. Knotts, Gary, Ind., vice presidents; John MacVicar, secretary-treasurer, Des Moines, Iowa. The next meeting will be held in Atlanta.

Technical Organizations.

The annual meeting of the American Public Health Association will be held in Milwaukee, Wis., September 5, 6, 7, 8 and 9. W. C. Woodward, secretary, Washington, D. C.

The annual meeting of the Association of Edison Illuminating Companies will be held at Thousand Islands, N. Y., September 6, 7 and 8. Walter Neumuller, assistant secretary, 55 Duane street, New York City.

The annual convention of the International Association of Municipal Electricians will be held at Rochester, N. Y., September 6, 7, 8 and 9. Frank P. Foster, secretary, Corning, N. Y.

The annual meeting of the Michigan Gas Association will be held on board steamer sailing from Detroit, Mich., September 8, 9, 10, 11 and 12. Glenn R. Chamberlain, Grand Rapids Gas Light Co., secretary, Grand Rapids, Mich.

The annual convention of the Colorado Electric Light, Power and Railway Association will be held at Colorado Springs, Colo., September 21, 22 and 23. J. C. Lawler, secretary, P. O. Box 938, Colorado Springs.

The annual convention of the New England Water Works Association will be held at Rochester, N. Y., September 21, 22 and 23. Willard Kent, secretary, Narragansett Pier, L. I. The papers include six or seven descriptive of Rochester and its water works, "Steel Pipe Lines," "Ice Formation," "Statistics of Growth of Income," "Depreciation," "Transportation of Sand and Water in Pipes and Hose Lines," "Flies and Disease," "Corrosion of Metals."

The annual meeting of the National Irrigation Congress will be held at Pueblo, Colo., September 26, 27, 28, 29 and 30. Arthur Hooker, secretary, Pueblo.

The annual convention of the American Society of Municipal Improvements will be held at Erie, Pa., October 11, 12, 13 and 14. A. P. Folwell, secretary, 239 West Thirty-ninth street, New York City.

The seventh annual convention of the National Association of Cement Users will be held December 12 to 23, 1910, in the Concert Hall of the Madison Square Garden, New York City. The seventh annual exhibition of the association will be held combined with the first annual Cement Show of New York, under the auspices of the Cement Products Exhibition Co., of Chicago, Ill.

The annual summer meeting of the Connecticut Society of Civil Engineers was held at Scotland and New London, Conn., August 16. The members and their guests visited the dam and power station of the Uncas Power Co., at Scotland, and then took a special electric car for New London, passing through the towns of Windham and Norwich. After dinner, which was served at Ocean Beach, near New London, a short business meeting was held.

The annual convention of the American Association of Park Superintendents was held at Harrisburg, Pa., August 9 and 10. A special trip to Gettysburg was made August 11. Among the subjects treated in papers and addresses were the following: "The Latest Conclusions About Road Surfaces," W. H. Dunn, superintendent of

parks, Kansas City, Mo.; "Various Methods of Treating Roads in Omaha," W. R. Adams, Omaha, Neb.: "Reasons for Parks," J. Horace McFarland.

The Ohio Valley Exposition will be held in Cincinnati August 29 to September 24 to exploit the industries and resources of the Ohio Valley and the South and to celebrate the completion of the Fernbank dam, one of the permanent Ohio river improvements, as well as the centenary of steam navigation on the Ohio.

The fourth international conference on state and local taxation is held at Milwaukee under the auspices of the International Tax Association on August 30 to September 2.

The American Society of Engineering Contractors, of which Mr. D. E. Baxter, of 27 William street, New York City, is president, and D. J. Hauer, secretary, will hold their annual convention in St. Louis September 27, 28 and 29, in the Coliseum. The local committee on arrangements is E. H. Abadie, chairman, J. L. Westlake, W. C. Swartout and L. C. F. Metzger. Papers will be delivered by J. B. Goldsborough and Ed. Wegmann, both of New York, on "Dam Construction for City Water Supplies," and by George C. Warren of Boston on "Work Preliminary to Street Paving and Road Work." A banquet will be held and several sight-seeing trips will be made to important engineering work in and around St. Louis. The society now has 800 members.

The Cement Products Association promises two great shows this year, the first in Madison Square Garden, New York City, December 14 to 20, 1910, and the second in the Coliseum at Chicago, February 17 to 23, 1911. The successes of the past will doubtless be duplicated at both exhibitions, and those interested in any way in the use of cement can not afford to miss these shows.

The directors of the New York Bureau of Municipal Research are to conduct a correspondence school in municipal accounting and reporting, using $10,000 a year for three years, contributed by Herman A. Metz, former controller of New York City, as the guarantee fund.

The International Exhibition of Railways and Land Transport is now in full swing in Buenos Aires, Argentine Republic, and will be open until November 30.

The Pittsburg Civic Commission has published a report by B. J. Arnold, John R. Freeman and F. L. Olmsted on the purpose and progress of city planning in Pittsburg, discussing such subjects as steam and electric railroads, water transportation, floods, street systems, water supply, sewerage, public and private lands and buildings and control of them, and smoke abatement.

The Metropolitan Sewerage Commission of New York has published a report strongly opposing the proposed discharge of sewage into the Hudson river from the Bronx Valley sewer.

Arrangements are being made in Pittsburg for a mammoth land show, which is to be held October 17 to 29. The object of the exposition is to provide information to the farmer, the homeseeker and investor regarding land openings and developments in all sections of the country, and to show samples of the mineral, agricultural, horticultural and botanical products of the soil, and to teach the students and laymen educational facts concerning land reclamation and irrigation. The exhibits will include those of the United States Government, boards of trade, chambers of commerce, commercial bodies, land and irrigation companies and State exhibits from all parts.

The Oklahoma Cement Users and Contractors will meet at Oklahoma City, October 6, 7 and 8. The cement show will be held during the whole of the State Fair, September 27 to October 9.

Henry Mueller.

One of the most progressive firms in plumbing manufacturing is the Mueller

HENRY MUELLER.

Manufacturing Co., of Decatur, Ill. It was founded by H. Mueller, Sr., who died some ten years since, and has been continued by his five sons, the oldest of whom was Henry Mueller. The mechanical genius of the father was inherited by the son and the latter has probably done more than any other one man to standardize plumbing specialties and to improve their design and construction as well as to invent and design new additions to the trade, which have vastly improved conditions. The plumbing trade

has been practically revolutionized within Mr. Mueller's lifetime and his firm has done its full share in bringing about the improvement.

Mr. Mueller was stricken with apoplexy on August 13, dying within a few hours. The tributes to his memory by citizens of Decatur, by many of the seven hundred employes of whom he was the mechanical director, demonstrated his standing and the high opinion held by all concerning the quality of his life and work. The four brothers and a brother-in-law continue the business under the same name with the necessary changes in organization to fill the vacant space.

Technical Schools.

The Michigan College of Mines, Houghton, Mich., has issued its year book for the past year, with announcement of courses for 1910-11, also a list of graduates and a booklet of views of the college and its activities.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

Sept. 7-8: Computer in Coast and Geodetic Survey at $1,200 a year.

Sept. 14-15: Civil engineers and superintendents of construction in Quartermaster's Department at Large at San Francisco, Cal., Ft. Bayard, N. M., and Washington, D. C., at $1,500 a year each.

Oct. 5: Building inspector in Quartermaster's Department at Large, Ft. Crockett, Tex., at $900 a year.

Personal Notes.

Dr. A. G. Horine has been re-elected mayor at Brunswick, Md.

F. P. Kurtz has resigned as city engineer of Cottage Grove, Ore.

John Harvey of Hamilton, Ont., has been elected city engineer of Oxford, O.

B. W. Doremus has been elected chief of the fire department at Roselle Park, N. J.

John H. Marley of Baltimore, Md., has been appointed inspector of gas meters by the Utilities Commission.

E. M. Crooken has been appointed engineer and superintendent of the park district at East St. Louis, Ill.

G. H. Bryson has resigned as city engineer of Victoria, Wash., and has been succeeded by August Smith.

J. Edward Simmons, former president of the board of water supply of New York City, died August 5 at Lake Mohonk, N. Y.

C. E. Grunsky, former city engineer of San Francisco, Cal., but who has been located in New York City for several years doing work for the United States, has returned to San Francisco and will resume the practice of civil engineering at 2714 Steiner street.

The Roebling Construction Co. have removed their New York offices to the thirty-second floor of the Metropolitan Tower.

Charles A. Muller, of the Muller Gravel Heater Co., Milwaukee, Wis., has been appointed deputy highway commissioner of Milwaukee.

C. F. Kelly has been elected mayor of El Paso, Texas, to succeed Mayor W. F. Robinson, who was recently killed by a falling wall in a fire.

Charles A. Hammond, M. Am. Soc. C. E., former resident engineer of the sewage disposal works at Mt. Vernon, N. Y., has been made manager of the works.

H. H. Davenport has been appointed district superintendent of roads for Windham county, Connecticut, by the Connecticut State Highway Commission district.

Wm. H. Merrill of the Underwriters' Laboratories at Chicago, has published a paper giving a full statement of the objects of the tests and investigations undertaken by the institution.

Frederick H. Lewis, M. Am. Soc. C. E., has resigned as general manager of the Standard Portland Cement Co., Leeds, Ala., to spend several months in travel, but will continue to serve as vice-president and director of the company.

Charles Mulford Robinson, Rochester, N. Y., has made a study of the possibilities of beautifying the city of Waterloo, Iowa, and his report has been published in a handsomely illustrated booklet by the Civic Society of Waterloo.

Charles Whitney Baker, editor of the *Engineering News*, just after his arrival at Birmingham, England, July 25, to take part in the joint meeting of the American Society of Mechanical Engineers and the Institute of Mechanical Engineers of Great Britain, was taken seriously ill of scarlet fever. His return to New York will be delayed until the last part of September owing to the necessary isolation period.

Hon. W. F. Robinson, mayor of El Paso, Texas, was crushed to death August 14 by the falling walls of a building during a fire. Fireman Todd Ware was killed also at the same time, and firemen William Robinson and assistant fire chief Dave Sullivan badly injured. Mayor Robinson, who had been on the scene for two hours, observed that the walls were swaying with the wind and warned the firemen to leave the building. The walls fell, however, just as the firemen were starting to leave, and, tumbling towards the spot where the mayor stood, crushed him to death.

Mr. J. N. Chester, formerly chief engineer of the American Water Works and Guarantee Company, and Mr. Thomas Fleming, Jr., formerly principal assistant engineer in charge, design and construction section, Pennsylvania State Department of Health, announce the formation of a partnership for consulting engineering, with offices in the Union Bank Building, Pittsburg, Pa. The field to be covered will embrace water works and purification plants, sewerage and sewage disposal, power plants, reinforced concrete construction, appraisements, reports, operation and management of water, power, and sewage disposal plants.

MACHINERY AND TRADE

A New Sewer Cleaning Device.

A demonstration of a new sewer cleaning device was given in Kansas City before the mayor and members of the Board of Public Works. The device was exhibited by Mr. Henry Sieben by whom it was invented.

The machine is a tube, two feet long and about the size of an ordinary fire hose. It is equipped at the rear end for the attachment of a hose. At the other end is a small turbine engine, the revolutions of which propel an outside wheel to which are attached sharp hooks and broad brushes. A windlass is set up at a manhole and at the end of a cable reaching through the sewer the device is attached. It is then drawn throughout the length of the sewer with hose attached and the water running in from the rear turns the engine and the cleaning wheel.

The hooks grind the dirt, the water reduces it to a soft mixture which is easily carried ahead, and the scrubbing of the brushes concludes the cleaning process.

But this is not the finish of the job. A cylinder containing a disinfectant is carried at the rear of the machine and the fluid is sprayed about the inside of the pipes by the action of the water.

The Twentieth Century Grader.

The Baker Manufacturing Company of Chicago has put on the market a grader which is a many purpose machine, for it can serve as a road grader, land leveler, ditch cutter, border thrower, sage brush cutter, snow plow, shallow drain maker, lateral cleaner.

The contractor for road construction will be interested in the machine, for it is just the light grader which is needed for putting the sub-grade in shape. It can turn quickly in half the width of the street and so is specially valuable on streets built in short sections; and the grader can pass rapidly up one side of the street and down the other. Following after the plow it will break up the clods and level and shape to an even crown a hundred linear feet an hour of 24-foot street. On the country roads, which may be opened in longer sections, the grade will shape up about 2000 feet a day, reducing the cost of this work after plowing to one-fourth to one-third cent per square yard.

Stone road contractors will find the grader economical for spreading broken stone, reducing the cost of this operation to 1 or 2 cents a cubic yard. Stone is dumped in consecutive piles 24 inches high, each pile containing 2 cubic yards. The grader then cuts off the top, using the blade straight and makes the layer of stone continuous. For the final spreading the blade is set at an acute angle. One man can drive and handle the levers, and spread in two hours all the stone hauled 1½ miles in 10 hours with 6 teams, is the reported experience of one contractor.

One good point about the grader, suggested above, is the possibility of setting the blade at any desired angle, straight, right or left.

The street departments of towns and cities will find the grader of great value for moving snow. It cleans sidewalks at the rate of 600 to 800 feet of 6-foot walk in five minutes with a light team, and makes them clean. A 7-foot blade is set at the angle to cover a 6-foot walk, or a 6-foot blade for a 5-foot walk. The same machine can be used in other seasons for road grading. In the larger cities the grader is equally valuable for moving snow on the streets. In one hour the grader has moved into a windrow the snow from 7570 square yards of asphalt pavement. It will serve equally well for cleaning gutters or for pushing the snow into windrows in the gutters, according to the requirements. One man and a light team do this work.

There are so many uses for the machine that one article will not cover them all. Those who want the story all at once should send to the Baker Mfg. Co., Chicago, Ill., for a catalog.

Climatological Data.

The U. S. Weather Bureau prepares summaries of the climatological data of sections of the United States which are exceedingly convenient and should be called to the attention of engineers. The summaries for sections 67 and 68, together, covering the State of Indiana, are samples of the results. The precipitation tables give the monthly precipitation for all the years of observation, with monthly and annual means, for all the stations in the section, with elevation of station, grouping the stations according to drainage basins. Mean, maximum and minimum temperatures for each month in the year, with statement of number of years included in averages, are given, dates of first frosts and last frosts, average depth of snow, average number of rainy days.

The relative humidity, wind direction prevailing, average wind velocity, percentage of sunshine, are given for the principal station and for the principal stations in adjoining sections in other states. Monthly discharges of rivers in the section are also given when determined by the U. S. Geological Survey. The precipitation tables are also shown graphically.

Concrete in New England.

The Concrete Bureau, Old South building, Boston, Mass., has issued a directory of cement-concrete designers and constructors of New England which it sells at $2. The names are given in an alphabetical list, giving information about the business followed, and the names are arranged geographically in the fourth list, from which reference must be made to the first list for details. Another list gives names of business and professional men connected with cement-concrete interests, including men connected with the firms listed in the first list, professors in colleges, etc. This list is alphabetical and not geographical. There is also a geographical list of cement structures in New England with brief data concerning them.

The lists are surprisingly short and one who does not live in New England may perhaps be pardoned the inquiry whether that section of the United States is so small that the arrangement of names of men by post-office addresses is of secondary importance and may be safely ignored, as in the second list.

Cameron Septic Tank Patents.

The Cameron Septic Tank Company, 352 Monadnock Block, Chicago, Ill., has sent a letter to each municipality and to others operating sewage disposal plants involving the septic process, giving the present status of litigation on septic process patents, from which the following is abstracted:

Broad claims of patent No. 634,423 have been sustained and decreed valid by the United States Circuit Court of Appeals in the case of Cameron Septic Tank Co. vs. Saratoga Springs, et al. (reported at pages 453-464 of the 159 Federal Reporter).

The contention was then raised that the seventeen years term of the patent, extending to October 3, 1916, would be shortened by the expiration of foreign letters patent, of shorter term, on the same invention. Under an old statute this would have been true, assuming such foreign letters patent to be for the same invention, but the International Treaty of Brussels, which went into effect on September 14, 1902, abrogated the older statutory provision and freed every then existing United States patent from such dependence on any foreign patent. This matter we have now carried to the Supreme Court of the United States, the case now standing on the docket of that court for the October term, 1910. We are entirely confident that the Supreme Court, as the final arbiter of all matters involving the application of an international treaty, will decide this issue in favor of this patent, just as the same issue has recently been decided in favor of another patent in the United States Court of Appeals (Hennebique Co. vs. Myers, reported at pp. 873-874 and 880-891 of 172 Federal Reporter). Such a decision of the Supreme Court of the United States will be conclusive upon all of the other courts of the country, and all parties who have taken the risk of infringing this patent, on the theory that it would so expire, will be without recourse.

The position of the company regarding pressing of suits pending the decision in that referred to and regarding collection of royalties in case the suit is decided favorably to the company is then stated briefly but clearly.

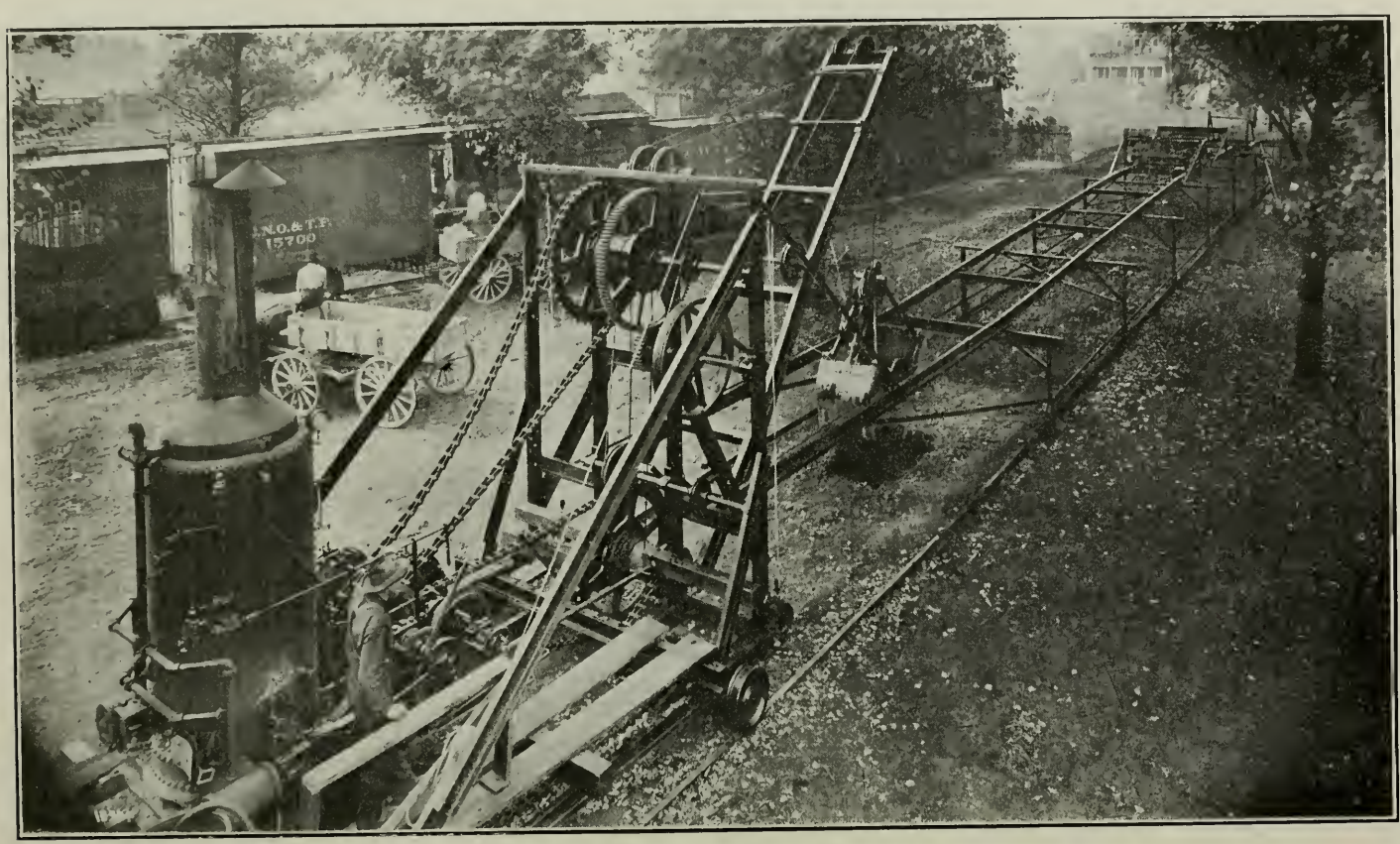
The Potter Trenching Machine.

Mr. Potter of the Potter Manufacturing Co., Indianapolis, Ind., has used the descriptive expression "Two in One" to designate their trenchng machine. The expression very fittingly describes the capability of the machine, for it accomplishes more than merely digging the trench in that it back fills the completed portion of the ditch as fast as the digging advances.

The accompanying photograph shows the machine and will serve to give some idea of its method of operation. The engine is a standard 20-horsepower engine that may be used for other work if the occasion demands. It is mounted, together with the hoisting machinery, on a platform of structural shapes, which is in turn mounted on wheels running on rails set 10½ feet apart. When in full operation the railway is continuous from end to end of the machine. To this platform is attached the boom of the digging apparatus. This boom is movable in a vertical plane and may be used in conjunction with either a clam-shell or orange-peel dipper bucket, or may be used as the ordinary steam shovel by attaching a scoop bucket rigidly to the boom arm.

Back of the digging machine extends a trestle, which may vary in length up to 300 feet. This trestle supports a track upon which a car is propelled by an endless cable operated by drums on the digging machine. At a suitable distance from the machine, braces are set at the sides of the track and a cross scraper is set at a suitable height above the track.

The method of operation is simple and effective and the entire apparatus is operated by one man. The bucket is dropped into the trench and fills itself. Then as it rises the same motion propels the car back from the farther end of the track until it is immediately under the bucket. The material is dropped on the car, which then proceeds outward along the track to the point where the cross scrapers shove the material off the car and into the trench. The motion which operates the car lowers the bucket; but after the car reaches the cross block at the end of the trestle the bucket may be lowered as much as required without in any way affecting the car. The width of the trench the machine is capable of digging is limited only by the distance between tracks.



THE NEW POTTER TRENCH MACHINE.

The machine can dig about 30 feet in a longitudinal direction at one set-up.

In moving forward all that is necessary is to throw in a gear operating a chain set on two gear wheels so as to engage itself in the ground under the engine. The entire apparatus is then moved forward on its own power. The trestle work, as well as the carriage supporting the engine and digging machinery, is set on wheels running on rails at either side of the trench, so that the machine is easily capable of moving along on its own power with little tractive resistance.

The advantages claimed for the machine are:

1. The trench is dug and back filled at one operation.
2. The depth of the trench is unlimited.
3. It can use either dipper or scoop buckets.
4. It can do double work on account of no time being lost in swinging the boom to either side.
5. It can dig any material short of solid rock.
6. The ditch is guarded by the presence of the trestle work on either side.
7. Tile may be laid immediately in advance of the fill without interference from the filling car.

Full information relative to the machine may be obtained from the Potter Manufacturing Co., Indianapolis, Ind.

A Money-Saving Trench Pump.

The C. H. & E. Manufacturing Co., 400 Mineral street, Milwaukee, Wis., have made a combination of a portable bilge or trench pump and a 3-h.p. gasoline engine on a strong skid, which is a time and muscle saver that the contractor will appreciate. It costs 20 cents a day to run the pump and it will lift 3000 to 3500 gallons an hour. Four men can carry and place it and it is always at work when wanted. The manufacturers claim that it will pay for itself on one job. The pump is of modern design and of high quality. Write to the manufacturers for further information.

Portable Acetylene Lights.

The portable light has long been a difficult problem for the contractor, as well as for others requiring lights temporarily, and with strength and flexibility enough to serve his purposes. Oil lights of all kinds are smoky, heavy or complicated or all three and are usually very inconvenient to handle. Acetylene gas makes an ideal light for such purposes, both for its convenience and portability and for its great power, being fifteen times as strong as any other burning light for the same size of flame.

The Milburn light is the result of ten years of scientific experimentation and that it is successful is shown by the sale of over 60,000 acetylene lights of over 60,000,000 candlepower.

An outer tank holds water and an inner tank holds carbide and there is a burner standpipe with a connecting flexible tube. These are the main pieces of apparatus.

There are several variations in design to fit the lamp for any demands that may be made on it, ranging in power from a 50-c.p. hand light to a 10,000-c.p. double lamp lighting 3000 feet.

The list of users of the light is long and includes many prominent contractors, factories, mines, railroads, steamships, fire departments, etc.

Not the least attractive feature of the light is its low cost.

The Alexander Milburn Co., 507 W. Lombard st., Baltimore, Md., will give full information about the light.

The Waterworks of Monterrey, N. L., Mexico

One of the most interesting features of the Monterrey (Mexico) water works system, which has just been completed, is the reinforced concrete distributing reservoir built for the low-pressure supply service, known as the San Geronimo gravity supply. This is situated at the extreme western limit of the city, at the foot of the Obispado hill. It is built of reinforced concrete throughout and its principal dimensions are as follows: Length, 120 linear meters (394 feet 8 inches); width, 80 meters (262½ feet); mean water depth, 4 meters (13 feet 1 inch); capacity, 40,000,000 liters (10,568,000 U. S. gallons). The top water level of the reservoir is 558 meters (1841 feet) above the sea level, and elevation sufficient to give a pressure over the district supplied varying between 27 and 70 pounds per square inch in the mains.

The reservoir has been partly excavated in a clayey formation composed of disintegrated "sillar," a local rock of secondary limestone formation, the excavated material being used to form the embankment on the north, south and east sides.

The embankments and excavated portion of the reservoir have been lined with concrete, 14 inches thick at the bottom and 10 inches thick at the top. The walls have a slope of 1 in 2 and are reinforced with ⅝-inch twisted steel lug bars. The columns supporting the roof are 16 inches in cross-section, reinforced with four ⅝-inch bars and hooped every 15 inches with ⅜-inch twisted steel. These rest on a foundation varying from 4 feet square on solid rock to 6 feet square on the softer strata of a portion of the reservoir foundation. The total number of columns is 360, spaced 5 meters (16 feet) apart. The roof consists of main primary beams 16x24 inches reinforced with four ¾-inch bars and 1x¼-inch flat stirrups, and secondary beams 10x20 inches with four ⅝-inch bars and 1x⅛-inch flat stirrups, which support a roof slab 4 inches thick reinforced with No. 8 gauge expanded metal.

The floor of the reservoir, which was

OBISPADO RESERVOIR, MONTERREY, MEX.—Laying "Pioneer" Waterproofing Asphalt on floor.

laid after a great part of the roof was completed, so as to get protection from the hot sun, is formed of two thicknesses of concrete. The lower, 5 inches in thickness, was laid in alternate panels between the columns, and upon this lower thickness a waterproof layer of asphalt was laid. The material used was supplied by the American Asphaltum & Rubber Company of Chicago, Ill., and the work was carried out by ordinary Mexican labor, after receiving a few days' instructions from one of the superintendents of the asphalt company. The concrete for the floor was composed of 3½ parts of crushed limestone, 2½ parts of the same rock crushed to form sand, and 1 part of the local Hidalgo Portland cement. The concrete was brought to a comparatively smooth surface and after having been kept moist for ten days by sprinkling was allowed to get thoroughly dry and the surface was carefully swept. Upon this prepared surface one coat of "Pioneer" paint was spread with paint brushes and the asphalt poured upon it to a depth of not less than ⅛ inch after having been heated in boilers and brought to a temperature of about 425 degrees F. Where the floor joined the pedestals of the columns two coats of asphalt were applied. The finishing coat of concrete was then placed in position on the top of the asphalt, laid in panels breaking joints with the lower panels, thus giving a total thickness to the floor of 10 inches, the floor surface being carefully finished with a float, the fine stuff being brought up to the surface, but no plastering was allowed.

For the purpose of determining if the reservoir showed any signs of leakage, rubble drains 15 inches wide and 9 inches deep were laid under the floor so as to lead any leakage there might be to a 12-inch drain carried to an inspection pit outside of the reservoir. Altogether there were about 1160 linear meters (3828 feet) of drain.

The construction of the concrete work of the reservoir, which occupied about six months, was begun in the middle of January and completed in the middle of July, 1909.

The following are some of the quantities of material used in this reservoir, including the inlet valve house, central tower, outlet house, etc.

Concrete, 6003 cubic meters (7984 cubic yards); steel reinforcing bars, 170 tons, or 55.1 miles; expanded metal for roof, 3½ tons, or 2.57 acres; number of columns, 360; number of primary beams, 374; number of secondary, beams, 1184.

In addition to "Pioneer" waterproofing asphalt, covering about 2½ acres of space and a coat of "Pioneer" primer paint, the walls of the reservoir internally were given two coats of "Te-Pe-Co" waterproofing (supplied through the American Asphaltum & Rubber Company of Chicago, Ill.). "Te-Pe-Co" is a liquid mineral solution and was applied with ordinary flat brushes, two coats covering about 2236 square meters of surface, the second coat requiring less solution than the first. The first coat was applied by four laborers, at 1 peso each per day, in twelve days, making the cost of the first coat 2.15 cents, Mexican, per square meter. The second coat was applied in four days by thirteen men, at a cost of 2.33 cents, Mexican, per square meter.

The reservoir was partly filled, to a depth of 6 feet, and allowed to remain so for several weeks, and no signs of any leakage were observed. The reservoir was then emptied and refilled on August 30, in forty hours, to its full capacity, when it became necessary to make use of the low-pressure supply, due to the recent flood, which temporarily cut off the supply main of the high-pressure reservoir. Since that date there has been no leakage whatever, proving that the methods adopted to insure water-tightness were successful.

The accompanying photographs show the work of painting the first layer of floor and laying the waterproofing asphalt. The reservoir has been laid out with grass plots and gravel paths, and the whole of the area owned by the company, amounting to about thirty acres, is being developed as a public park, which, when finished, will be the most beautiful of its kind in Mexico.

The reservoir was designed by Mr. G. R. G. Conway, M. Am. Soc. C. E., M. I. Mech. E., and built under his direction.

How to Lay Bitu-Mass.

The American Paving and Manufacturing Co., Indianapolis, Ind., have issued the following specifications for laying Bitu-Mass pavement, showing the results of their careful experimentation for the past few years:

Foundation.—The earth, foundation or sub-grade will be brought to an even surface, parallel with the grade proposed for the pavement, by making the necessary excavation or embankment. Soft or spongy earth, or other material not affording a firm foundation, will be removed and the space refilled with dry earth, which shall be solidified by ramming or rolling. Any portion of the earth foundation not accessible to the roller shall be thoroughly compacted by ramming. When the rolling and ramming shall have been done, the surface of the earth foundation shall be true and smooth, and 5 inches below the proposed finished surface of the pavement.

Pavement.—Upon the earth foundation or sub-grade, prepared as above described, shall be laid the Bitu-Mass pavement, which pavement shall be composed of a natural mixture of bank or river gravel and sand, from which all stones above 1 inch have been removed, and bituminous cement, treated and laid as hereinafter specified.

The completed pavement shall be 5 inches in thickness, and shall be made as follows: The gravel and sand as above described shall, before being mixed with the bituminous cement, be passed through a rotary dryer and there subjected to a direct heat for the purpose of expelling moisture, and for the further purpose of causing these ingredients to readily unite

OBISPADO RESERVOIR, MONTERREY, MEX.—Painting the first layer of the floor.

with the bituminous cement. Before being discharged from the dryer, the gravel and sand shall be heated to a temperature of approximately 200 to 250 degrees F., the bituminous cement to be heated to approximately 250 to 300 degrees F.

Bituminous Cement.—The bituminous cement used in this mixture shall be the American Paving and Manufacturing Company's Jay brand bituminous cement.

Pavement Mixture.—The amount of bituminous cement to be used shall be determined by the amount required to thoroughly coat each particle of the gravel and sand, and to fill the remaining voids in the mixture. After the formula is thus obtained, giving the exact amount of weight of the gravel and sand, and the exact amount of cement for one batch, the same shall simultaneously be dumped into the mixer and the whole compound thoroughly agitated until all the particles are thoroughly coated, and the combination is a uniform, dense and plastic bituminous concrete.

In this condition it shall be spread on the prepared foundation or sub-grade in two courses or layers, as follows: The first or lower course shall contain a slightly larger percentage of the cement than the second or upper course, and shall be at least 3 inches in thickness after being thoroughly compressed by rolling with a steam roller weighing at least 8 tons. The second or upper course shall then be spread on top of the lower course to such a depth that, after thorough compression with a steam roller weighing at least 8 tons, the two courses (or the entire pavement) shall have a thickness of 5 inches.

Surface Finish.—After the second or upper course has been laid to grade and rolled, and while still warm, a thin coating of Portland cement shall be swept over it, after which the rolling shall be continued until the pavement has been properly compressed.

Asphalt and Cement Testing.

The number of municipal laboratories for testing cement and for testing asphalt is rapidly increasing. The cost of apparatus is so slight that it no longer stands in the way, and the necessity of sufficiently expert supervision of construction of pavements and cement work to insure good materials has been demonstrated so conclusively that no city which is doing enough work to keep its city engineer busy can afford to neglect its testing laboratory.

Chicago now has a firm which devotes its attention to the manufacture of such apparatus, both the standard machines and tools and special apparatus to suit any particular requirements. It is fair to presume that a firm thus putting its full force on the one class of machinery is able to turn out specially satisfactory products. The Humboldt Mfg. Co., 2014 Nebraska avenue, Chicago, Ill., is the firm referred to and they will give full information on the subject of testing laboratories and apparatus on request.

Trade Publications.

The Twentieth Century grader is fully described in its many uses by the Baker Mfg. Co., Chicago, Ill., in an illustrated catalog.

High-grade engineering instruments are listed and described in a handsomely illustrated catalog of the Hanna Mfg. Co., Troy, N. Y.

The De Laval Steam Turbine Co., Trenton, N. J., discuss high efficiency of centrifugal pumps in a 96-page book.

Two recent booklets from the Indianapolis office of the Lehigh Portland Cement Co. describe the reinforced concrete plant of the Grape Products Co., at North East, Pa., and some reinforced concrete chimneys, with views of numerous other structures in which Lehigh cement has been used, including the brick pavement in the Indianapolis motor speedway.

The Stark Rolling Mill Co., Canton, O., has issued an interesting booklet entitled "A Valuable Treatise on Corrosion of Iron and Steel."

The Universal Portland Cement Company's latest *Farm Cement News* gives full instructions for making concrete posts and fences.

Geo. W. DeSmet, Chicago, Ill., issues a booklet of specifications for using white Portland cement mortar.

Merritt & Co., Camden, N. J., issue occasional booklets on progress in sewage treatment.

One of the handsomest catalogs received is one showing "A Quarter Century's Achievement of the Kelly-Springfield Road Roller."

The Barrett Mfg. Co. takes advantage Norfolk, Va.—The special water comof a slight mis-statement regarding tests of waterproofing materials to make a handsome correction in an equally handsomely clothed illustrated booklet about the use of coal tar pitch and the Barrett Specification in the new Pennsylvania Terminal Station in New York City.

Riehle Bros. Testing Machine Co. issue a large catalog of the large variety of U. S. standard testing machines of their manufacture.

The latest Edison *Aggregate* shows walls, piers and pockets of reinforced and plain concrete.

What do engineers think of Pioneer asphalts is answered by a map showing the cities in which they are used, which is issued by the American Asphaltum and Rubber Co. of Chicago.

The Lykens Valley Board of Trade is a new organization at Gratz, Pa., which announces its beginning with a handsome pamphlet on "The Awakening of Lykens Valley."

The latest circular of Bruno Grosche & Co., 5 Jones Lane, New York City, on S. P. F. Carbolineum and S. P. F. oil is entitled "A Handsome Walnut Stain" and shows pictures of a number of residences, factories, barns, etc., on the roof and outside woodwork of which these oils have been used.

Keuffel & Esser Co.'s latest catalog of draftsmen's, engineers' and surveyors' instruments and supplies has been received.

The Universal Portland Cement Co.'s bulletin No. 75 shows a number of reinforced concrete structures, and describes

the grandstand of one of the Chicago baseball parks.

Several booklets and circulars have been received which set forth the merits of Sarco for waterproofing foundations, track elevations and other structures, and for roof coating, Sartac for damp-proofing and Smearon for leaky roofs, all made by the Standard Asphalt and Rubber Co., Chicago, Ill.

The Tide Water Iron Works, Hoboken, N. J., issue a new catalog of their specialties, which include the Mullen gravel heaters, tar kettles and combinations of the two, asphalt kettles, reheating asphalt pans, fire wagons and asphalt paving tools of all kinds.

J. W. Howard, C. E., sets forth the facilities of his testing laboratory and inspection service for street paving in a well-worded letter from his office, 1 Broadway, New York.

Frank Cerruti, New York, sends copy of his patent on a means of cleaning sewers, showing bucket, frames, engine and method of drawing bucket through sewer, up one manhole to dump into cart and down the next manhole.

A. A. Goubert, New York, supplies steam pile driving outfits and sends a description of their operation.

Warren Smith, Faribault, Minn., has control of the Thomas concrete sewer form, of which he sends an illustrated description.

Herman F. Cuntz, Hartford, Conn., sends copy of patent for a snow-melting machine.

Henry Sieben, Kansas City, Mo., has invented a system of cleaning and disinfecting sewers which acts on a new principle and after test by the department of street repairs has been adopted for use.

Trade Notes.

ASPHALT.

Waterloo, Ia.—The asphalt plant of the Bryant-McLaughlin Company was damaged by fire July 31, entailing a loss of $1,000.

Cleveland, O.—The U. S. Circuit Court has decided that the Atlas patent dryer of the Atlas Dryer Co. does not infringe the Cummer dryer.

BRICK.

Tulsa, Okla.—The new plant of the Tulsa Paving & Building Brick Company has been put in operation.

CEMENT.

Jamaica, Ia.—A. T. Drackley of Rippey, Ia., has purchased one-half interest in the cement products business of L. Adams of this place. The machinery will be moved to Rippey and the business extended.

Ft. Dodge, Ia.—The establishment of another Portland cement plant at or near here is contemplated, according to press reports, which record the information, in West Virginia, of the Fort Dodge Portland Cement Company, which is said to have large deposits of cement shale at Gilmore City. It is not known, however, whether the plant will be located there or in Fort Dodge, where a suite of offices has been secured in the First National Bank Building. The incorporators are: F. D. Brandenberg of Sioux Falls, S. D.; M. J. Nicholson, H. W. Hendricks, Rapid City, S. D.; H. S. Van Alstine, F. J. Fishenbanner, Gilmore City.

Faribault, Minn.—D. Grant & Co., of this city, has purchased machinery for the proposed cement plant to be established at Yellowstone Park, Wyo., by the Yellowstone Portland Cement Company, in which the firm is interested.

The Roosevelt dam on Salt river in Arizona is completed and the mill, owned by the United States, which made the cement for it, will be sold at auction. The mill is said to have saved $675,000 in the construction of the dam.

CONCRETE.

Superior, Wis.—Whitney Bros. have in contemplation the establishment of a cement plant at Duluth, similar to their plant here.

Pilot Mound, Ia.—The establishment of a cement tile plant here is contemplated by N. B. Twogood of Emmetsbury, Ia.

Renwick, Ia.—W. E. Harvey will establish a cement block and tile plant here.

PURCHASE OF MACHINERY.

Antigo, Wis.—Special.—Alex Daleglis, cy. engr., is in the market for a cement testing outfit.

Omaha, Neb.—Special.—Guy Dann, 3901 N. 17th st., is in the market for a cement mixer.

Harrison, N. Y.—Special.—Wm. J. Stockmann desires to purchase two second-hand steam drills and one 20-h.p. boiler upright on wheels.

The Dalles, Ore.—Special.—L. T. Boyle, P. O. Box 237, says the question of purchasing dump wagons is still under consideration, and possibly street sweepers.

MISCELLANEOUS.

Newark, N. J.—The Sanitary Engineering & Contracting Co., 9-11 Clinton st., has been incorporated to acquire all kinds of refuse, waste, garbage, etc., and manufacture by-products therefrom by secret process. Patrick M. Lynch, Fred C. Fowler and Arthur Gutman of New York, and Abraham Henig of Newark are the incorporators.

New York City.—The construction department of the Safety Insulated Wire & Cable Company has been awarded a contract by the Middletown Gas & Electric Light Company, Middletown, Ohio, for laying underground electrical conduits and installing cables in that city for approximately $12,000. Work is progressing rapidly and the company expects to operate part of the system by September 1.

The Richmond Water Works, Richmond, Va.; Bayhead Artesian Water Co., Bayhead, N. J.; Central Union Gas Co., New York City; Oak Park Power Co., Flint, Mich.; Consolidated Ice & Power Co., Valdosta, Ga.; Peoples Incandescent Light Co., Meadville, Pa.; Greenfield Gas Light Co., Greenfield, Mass.; City Water Works, Richmond, Va.; Consolidated Gas Company of New York, 47th street and North river, New York City, have recently made purchases of Swartwout system specialties made by the Ohio Blower Co., Cleveland, O. Their patents include cast iron exhaust heads, centrifugal separators and automatic gauge glasses.

A. P. Smith Manufacturing Company, Newark, N. J., has removed its offices and works to Watsessing, N. J., where larger and more up-to-date shops will allow a greatly increased output.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Milwaukee, Wis.—Brick paving is contemplated for North and 8th aves.

Hutchinson, Kas.—This city contemplates repaving and resurfacing Main st.

Brainerd, Minn.—Council will be petitioned to pave 3rd ave. with cement.

Iowa City, Ia.—Macadam paving and curbing is contemplated for Fairchild st.

Rochester, Minn.—Creosoted wood block is contemplated for Broadway st.

Santa Clara, Cal.—Specifications have been prepared for street improvements.

Portsmouth, O.—Ordinances have been adopted for improving 2nd and Offnera sts.

Beloit, Wis.—About 1 mi. of brick paving is contemplated. Robt. R. Caldwell, cy. engr.

Rochester, Pa.—Will vote in November on the issue of $100,000 bonds for paving streets.

Menasha, Wis.—The city council decided to pave Chute st., from Tayco to Main, next year.

Bedford, Ia.—Paving, curbing, etc., is contemplated for Washington and other streets.

Baltimore, Md.—B. T. Fendall contemplates resurfacing the cobblestone streets with asphalt.

Everett, Mass.—Brick and asphalt paving is contemplated for Pacific ave. and other streets.

Birmingham, Ala.—Ordinances for paving 4 streets with bitulithic are being considered by council.

Madison, Wis.—Council has ordered about 1600 sq. yds. of sheet asphalt paving on State and Pike sts.

Haywards, Cal.—Permanent paving for all unimproved streets is contemplated. T. S. Gray, town atty.

Decatur, Ill.—Ordinances have been passed for paving N. College and Broadway sts. and E. Leafland ave.

Pomona, Cal.—The board of trustees has under consideration the repairing of the asphalt pavement in 2nd st.

Independence, Kas.—Plans have been prepared for about 35 blocks of brick paving. A. D. Stivers, cy. engr.

North Yakima, Wash. — Preliminary plans are being made for constructing 5 blocks of asphalt paving in 11th st.

Hampton, Ia.—The bids submitted recently for paving were too high, and the work was deferred for another year.

Stuttgart, Ark.—Brick paving is contemplated for the main business streets and macadam for the residence streets.

Marietta, O.—An ordinance has been adopted providing for brick paving in Montgomery st. J. Henry Best, clk.

Logansport, Ind.—Paving is contemplated for Broadway, but the material has not yet been decided upon. H. H. Thompson, cy. engr.

Marshalltown, Ia.—The specifications for brick paving in this city have been changed to provide for gravel base instead of crushed stone.

Springfield, O.—Ordinances have been passed and contracts will be let about Sept. 1 for paving W. Main and E. High sts. and College ave.

Clinton, Ia.—Special.—R. C. Hart, cy. engr., has been directed to make plans and estimates for paving 3rd ave. W. E. Hayes, co. clk.

Columbus, O.—An ordinance has been passed providing for asphalt paving in Indianola ave. About 2½ mis. of paving is contemplated for N. High st.

Edna, Tex.—The county commissioners voted to issue $100,000 bonds for constructing good roads and drainage under the supervision of a competent engineer.

Wheeling, W. Va.—The board of control has asked council to appropriate $12,000 for repaving 3 blocks of Main st., and $18,100 for repaving 5 blocks of McCulloch st.

Tacoma, Wash.—The board of county commissioners has decided to construct a scenic drive along the bluff in the west side of Comment Bay, 5½ mis. long, at a cost of $47,000.

Wilmington, N. C.—Special.—The street commission proposes to commence paving the streets some time in October. No special class of paving material has yet been selected, and the commission invites correspondence from the manufacturers of different kinds of paving material, giving information as to the different towns in which the paving is laid, the amount of paving laid, and the cost per square yard. Also, where any of the different kinds of material is at present being laid. Louis S. Belden, chm.; C. R. Humphreys, engr. comn.

Seattle, Wash.—Estimates have been reported by R. H. Thomson, cy. engr., of the cost of street improvements as follows: 34th ave., N. W. and other streets, grading, $16,800; Harrison st. and other streets, grading, $67,500; West Alaska st. and other streets, grading, $109,000; Rainier ave., grading, $32,500; 32d ave. and other streets, concrete walks, $3,900; E. 45th st. and other streets, paving, $13,000; Beacon ave. and other streets, paving, $100,000; McLellan st. and other streets, paving, $26,000; 38th ave. and other streets, paving, $18,200; Eighth ave. S., paving, $77,000; 15th ave., W., planking, $4,800; Olive st. and other streets, planking, $12,600.

Peoria, Ill.—Creosoted wood block paving is now advocated for Adams st.

Memphis, Tenn.—An ordinance has been passed to pave Springdale st. with tar macadam.

Mishawaka, Ind.—The construction of a system of paved streets this fall is contemplated.

San Antonio, Tex.—Asphalt paving is contemplated for Roosevelt ave. to the Fair grounds.

Virginia, Minn.—The residents of Poplar st. have petitioned for creosoted wood block paving.

Philadelphia, Pa.—Mayor Reyburn is in favor of resurfacing Broad st. from Jackson st. to Olney ave.

Wichita, Kan.—A resolution has been passed to pave St. Francis ave. with bitulithic. Wm. Sence, cy. clk.

Richmond, Ind.—Plans are being prepared and bids will be asked for wid-

ening, curbing and paving W. 7th, W. 8th and W. 9th sts. H. H. Hammond, prest. B. P. W.

Marshalltown, Ia.—City council voted, Aug. 22, to pave 6¼ blocks of street and alleys with brick.

*Guthrie, Okla.—The construction of over 8,000 lin. ft. of cement sidewalks this fall is contemplated.

Crawfordsville, Ind.—Bids will be asked shortly for paving Sloan st. and Wabash ave. with brick or asphalt.

Iowa City, Ia.—The city council has acted favorably upon a resolution to pave a number of streets with bitulithic.

Decatur, Ind.—The city council has authorized the preparation of plans and specifications for about 3 mis. of brick paving.

Trenton, N. J.—Plans have been approved for resurfacing the Medlow turnpike, the main entrance by automobile to Atlantic City.

Hiawatha, Kas.—Plans and specifications have been approved for paving and curbing Oregon, 6th and 7th sts. J. T. Grimes, mayor.

Council Bluffs, Ia.—A resolution has been passed to repave Broadway and Main sts. with vitrified brick. S. L. Etnyre, cy. engr.

CONTRACTS TO BE LET.

Peru, Ind.—Bids are asked until Sept. 6 for constructing gravel roads. Chas. Griswold, co. audt.

Decatur, Ind.—Bids are asked until Sept. 5 for constructing a macadam road. H. S. Michaud, co. audt.

Tipton, Ind.—Bids are asked until Sept. 5 for constructing a stone road. J. F. Barlow, co. audt.

Greensburg, Ind.—Bids are asked until Sept. 5 for constructing macadam roads. Frank E. Ryan, co. audt.

Muncie, Ind.—Bids are asked until Sept. 7 for improving a public highway. Jos. E. Davis, co. audt.

Paoli, Ind.—Bids are asked until Sept. 6 for constructing 2 gravel roads. Alvin B. Ham, co. audt.

Sullivan, Ind.—Bids are asked until Sept. 6 for constructing a stone road. Ben. C. Crowder, co. audt.

Fowler, Ind.—Bids are asked until Sept. 5 for constructing a stone road. Lemuel Shipman, co. audt.

Oakland, Cal.—Bids are asked until Sept. 7 for improving 12th st. Walter B. Fawcett, secy. B. P. W.

Bronxville, N. Y.—Bids are asked until Sept. 6 for grading and paving Midland ave. Frank Dinsmore, vil. clk.

New Brunswick, N. J.—Bids are asked until Sept. 6 for constructing a stone road. Bd. chosen freeholders.

Spencer, Ind.—Bids are asked until Sept. 6 for constructing a macadam road. Geo. W. Edwards, co. audt.

Marion, Ind.—Bids are asked until Sept. 5 and 6 for constructing macadam roads. A. Y. Stout, co. audt.

Lafayette, Ind.—Bids are asked until Sept. 7 for constructing 3 gravel roads. John P. Foreman, co. audt.

Euclid, O.—Bids are asked until Sept. 12 for paving Lawnview ave. with brick. Nelson J. Brewer, vil. clk.

Rushville, Ind.—Bids are asked until Sept. 5 for constructing a macadam road. Jesse M. Stone, co. audt.

Crown Point, Ind.—Bids are asked until Sept. 6 for constructing 6 gravel roads. Chas. A. Johnson, co. audt.

Lacon, Ill.—Bids are asked until Sept. 5 for constructing a concrete sidewalk in 5th st. T. G. Green, co. clk.

Lebanon, Ind.—Bids are asked until Sept. 8 for grading, draining and gravelling a certain public highway in Sugar Creek twp. B. F. Herdrich, co. audt.

Wabash, Ind.—Bids are asked until Sept. 6 for constructing gravel and macadam roads. J. P. Noftzger, co. audt.

Vernon, Ind.—Bids are asked until Sept. 5 for constructing 2 pike roads in Campbell twp. T. L. Thomas, co. audt.

Vicksburg, Miss.—Bids are asked until Sept. 5 for widening and grading Ward Hill. J. D. Laughlin, chancery clk.

Youngstown, O.—Bids are asked until Sept. 6 for paving Caroline st. and grading Quarry, Decatur, Union and Pyatt sts.

Belleville, Ill.—Bids are asked until Sept. 3 for constructing a macadam road in O'Fallon twp. Comrs. highways.

Harrisburg, Ill.—Bids are asked until 10 a. m. Sept. 3 for constructing 1 mi. of stone macadam road. C. S. Wills, twp. clk.

Oakland, Cal.—Bids are asked until Sept. 8 for constructing an asphalt roadway in Lakeside Park. Henry F. Vogt, secy. park comn.

Youngstown, O.—Bids are asked until Sept. 6 for grading the hills on Canfield and Ellsworth roads. Will B. Jones, co. audt.

Newark, N. J.—Bids are asked until Sept. 8 for paving Pleasant Valley Way with telford. Wallace Ougheltree, dir. freeholders.

Williamsport, Ind.—Bids are asked until Sept. 5 for constructing gravel roads in Pine and Steuben twps. Robt. L. Winks, co. audt.

Harrisburg, Pa.—Bids are asked until Sept. 16 for reconstructing the National road in Brownsville borough. Joseph W. Hunter, state highway comr.

Hermosa Beach, Cal.—Bids are asked until Sept. 23 for constructing Warrenite paving on 5-in. bituminous concrete base. E. McCoskey, co. clk.

Ft. DuPont (Delaware City, Del., P. O.) —Bids are asked until Sept. 12 for macadamizing a section of Port Penn road. Constr. Q. M.

Kewanee, Ill.—Bids are asked until Sept. 6 for constructing a macadam walk, bridge and fountain base in West Park. O. D. Peterson, cy. clk.

Watertown, S. D.—Bids are asked until Sept. 6 for constructing curb and gutter along the north side of the court house square. E. L. Lampy, co. audt.

Blountsville, Ind.—Bids are asked until Sept. 6 for constructing about 3 mis. of cement sidewalks. L. J. Templin, prest. town bd.; J. C. Curtis, town clk.

Jackson, Miss.—Bids are asked until Sept. 6 for paving N. State st. with bitulithic, mineral rubber, wood block and asphalt. J. N. McLeod, st. comr.

Indianapolis, Ind.—Bids are asked until Sept. 2 for grading, graveling and sodding school grounds of No. 35 at Madison ave. and Raymond st. John E. Cleland, business dir. bd. school comrs.

New Orleans, La.—Bids are asked until Sept. 6 for creosoted wood block paving on concrete, on the river front, from Jackson ave. to St. Mary st. Hugh McCloskey, prest. bd. comrs.

Chicago, Ill.—Bids are asked until Sept. 2 for paving a number of streets with vitrified brick, creosoted wooden blocks, asphalt, etc. Albert F. Keenen, prest. bd. local impvts.

Buffalo, N. Y.—Bids are asked until 11 a. m. Sept. 2 for paving Vandalia, Republic, Ledger, Barton and Reno sts. with each kind of pavement specified in specifications. Francis G. Ward, comr. pub. wks.

Huntington, W. Va.—Bids are asked until 1 p. m. Sept. 2 for 56,500 sq. yds. of vitrified brick, sheet asphalt, asphalt block or bitulithic paving, and 24,000 lin.

ft. curb. John Coon, comr. sts.; A. B. Maupin, cy. engr.

Billings, Mont.—Bids are asked until Sept. 6 for constructing 276,366 sq. ft. of concrete sidewalks, 33,099 ft. curbing, and 13,873 ft. of cross walks. J. D. Mathewson, cy. clk.

Waukesha, Wis.—Bids are asked until Sept. 6 for constructing 12,140 sq. yds. of tar macadam paving, 6632 lin. ft. concrete curb, and 3076 cu. yds. excavation, in West ave. M. R. Butler, cy. engr.

Montevideo, Minn.—Bids are asked until Sept. 12 for constructing sidewalks. Cy. clk.

Hermosa Beach, Cal.—Bids are asked until Sept. 23 for Warrenite paving on 5 in. bituminous concrete base. E. McCoskey, cy. clk.

Tenafly, N. J.—Bids are asked until Sept. 14 for constructing a stone road. Maurice E. Lindsay, boro. clk.

Scarsdale, N. Y.—Bids are asked until Sept. 12 for resurfacing the New York Port road with bituminous macadam. Frank Sibley, town clk.

Mansfield, O.—Bids are asked until Sept. 8 for constructing 60,000 sq. ft. of cement sidewalks, and 2,000 cu. yds. of grading.

Hartford, Conn.—Bids are asked until Sept. 2 for constructing state roads in towns of Bloomfield, East Granby, Sunsbury, New Hartford, etc. State highway comr.

Atlantic, Ia.—Bids are asked until Sept. 8 for 3 mis. of asphaltic concrete paving and 6 mis. of cement curb. T. E. Nichols, cy. clk.; Chas. P. Chase, cons. engr., Clinton.

Olean, N. Y.—Bids are asked until Sept. 13 for constructing vitrified brick paving in Whitney ave., and until Sept. 15 for vitrified brick paving in Green st. Geo. H. Luther, comr. pub. wks.

CONTRACTS AWARDED.

Sandusky, O.—The contract for paving Neill st. with brick was awarded to Anthony G. O'Donnell.

Vincennes, Ind.—John Hunchler, of this city, was awarded a contract for building a gravel road.

Saginaw, Mich.—The contract for paving Genesee ave. with macadam was awarded, Aug. 23, to Crowley Bros.

Nashwank, Minn.—The contract for paving Central ave. was awarded to E. A. Dahl for $7,935.

Akron, O.—The contract for paving E. Market st. with brick was awarded to Wilders & Davison.

Clinton, Ia.—Carey & Son secured the contract for paving Main st., in Lyons, for $22,146.42.

Washington, Ind.—The contract for graveling a road was awarded to Albert Musselman for $2,499.

Youngstown, O.—The contract for paving Poland ave. was awarded to Charles Harris & Son for $32,216.

Winona, Minn.—Otis Abell secured the contract for paving Franklin st. with brick for $7,845.

Marion, Ind.—The contract for improving Adams st. was awarded to Dillard Artis at $6.87½ a lin. ft.

Antigo, Wis.—W. H. Fisher was awarded a contract for 4 blocks of macadam paving, for $81,624.

Morgantown, W. Va.—Anthony Pietro was awarded a contract for paving Holland ave. for $15,328.

Chippewa Falls, Wis.—The Concrete Co. was awarded the contract for building cement sidewalks in Bridge st.

McConnellsville, O.—The contract for paving Kennebec ave. and East and Vine sts. was awarded to Frank Beckwith, for $6,588.

Huntington, W. Va.—The contract for paving 2 blocks of Maple ave. was awarded to Henry Wright, at $1.40, and for 2 blocks in 5th ave. to Harrison & Dean at $1.42 a sq. yd.

Akron, O.—The contract for constructing stone curbing in E. Market st. was awarded to Wildes & Davidson, for $15,515, who also secured the contract for improving Renmore road, for $35,588.

Batavia, Ill.—The contract for 26,612 sq. yds. of tar macadam paving and 6,856 lin. ft. combined curb and gutter was awarded to the Interocean Paving & Construction Co., 108 Dearborn st., Chicago, for $24,875.

Leland, Miss.—The Clements Construction Co. has been awarded a contract for constructing sidewalks.

Alexandria, Ind.—J. W. Sullivan has been awarded a contract for constructing a gravel road for $2,225.

Pittsburg, Pa.—The contract for constructing the Crab Hollow road was awarded to A. G. Rothey for $17,743.89.

Bayonne, N. J.—The contract for 16,150 sq. yds. of paving in Prospect ave. was awarded to the Standard Bitulithic Co.

Youngstown, O.—The contract for paving Roland ave. was awarded to Chas. Harris & Son, Aug. 1, for $32,216.

Evansville, Ind.—The contract for paving Governor st. with brick will probably be awarded to the Bedford-Nugent Co.

Bloomfield, Ind.—Thos. Stinhard was awarded a contract for constructing a macadam road in Stockton twp. for $5,993.

Liberty, Mo.—The contract for paving the public square was awarded, Aug. 12, to J. T. Carr at $1.98½ a sq. yd.

Peoria, Ill.—John W. Bushnell was awarded a contract for resurfacing N. Madison ave. with asphalt for $33,494.08.

Ashland, Ore.—The contract for paving several streets, aggregating 62,978 sq. yds., was awarded to the Warren Construction Co.

Berlin, Ont.—Special.—The Warren Bituminous Paving Co. has been awarded a contract for 7,733 sq. yds. of bitulithic paving.

Negaunee, Mich.—The contract for paving a number of streets has been awarded to Wrick O'Connell & Co., of Houghton.

Toronto, Ont.—Special.—The contract for 6,077 sq. yds. of bitulithic paving was awarded to the Warren Bituminous Paving Co.

Walla Walla, Wash.—The contract for paving E. Alden st. was awarded to the Pacific Paving Co. at $1.87 a sq. yd.

Normal, Ill.—The contract for paving Ash st. was awarded, Aug. 11, to Roy Williams, of Bloomington, for $9,985.88.

Crawfordsville, Ind.—The contract for constructing a macadam road was awarded to Geo. B. Lynch, of Darlington, Ind.

Los Angeles, Cal.—The Barber Asphalt Paving Co. has been awarded the contract for improving Grand ave., for $8,824.

Hermosa Beach, Cal.—The contract for improving Primrose ave. was awarded to the Barber Asphalt Paving Co., for $6,000.

Reading, Pa.—The contract for paving Spring st. with drainage appurtenances was awarded to Fehr & O'Rourke, for $10,286.

Cincinnati, O.—The Kirchner Construction Co. was awarded the contract for paving York st. with granite, for $10,276.10.

Herkimer, N. Y.—The contract for paving 11,451 sq. yds. of Main st. with bitulithic was awarded to Warren Bros. Co.

Binghamton, N. Y.—The contract for resurfacing Henry st. with brick was awarded to A. D. Osborne, at $1.77 a sq. yd.

Woodburn, Ore.—Special.—The Warren

Construction Co. has been awarded a contract for 8,526 sq. yds. of bitulithic paving.

Ft. Worth, Tex.—Special.—The Texas Bitulithic Co. has been awarded a contract for 16,500 sq. yds. of bitulithic paving.

Terra Alta, W. Va.—Bateson & Co., of Wheeling, was awarded a contract, Aug. 3, for paving 1 mi. of State st., for $34,800.

Kankakee, Ill.—The contract for paving E. Court st. was awarded to John Hayes & Sons, of Naperville, for about $20,000.

Steubenville, O.—Floto Bros. Construction Co. was awarded a contract for paving and curbing Barclay ave., for $14,411.

Washington, D. C.—The contract for grading, setting and resetting curb and cobble gutters was awarded, Aug. 15, to E. G. Gummal, 300 Rhode Island ave., N. W., at 39, 27 and 37 cts. respectively.

Freeport, Ill.—The contract for paving Liberty st. with brick was awarded to Finley & Lewis, of Hoopeston, Ill., for $4,002.10.

Allentown, Pa.—George H. Hardner, of this city, was awarded a contract for building 7,000 ft. of trap rock road to Guthsville.

Sandusky, O.—The contract for paving Washington and Franklin sts. with Trinidad asphalt was awarded to the Andrews Asphalt Co.

Bloomington, Ill.—The contract for paving W. Washington st. with brick was awarded to I. D. Lain, of this city, at $1.92 a sq. yd.

Camden, N. J.—The contract for constructing an amiesite road was awarded, Aug. 10, to E. C. Humphreys, of Hackensack, for $12,114.

Herkimer, N. Y.—Special.—The contract for 11,451 sq. yds. of bitulithic paving in Main st. has been awarded to Warren Brothers Co.

York, Pa.—Special.—The contract for 1500 sq. yds. of bitulithic paving in Manchester st. was awarded to the Standard Bitulithic Co.

Houston, Tex.—The Texas Grading Co. was awarded the contract for rebuilding 2 mis. of the W. Montgomery road, for $12,000.

Elizabeth, N. J.—Special.—The contract for 4,500 sq. yds. of bitulithic paving in N. Broad st. has been awarded to B. H. Winans Co.

Salem, Ore.—Special.—Additional contracts for 31,903 sq. yds. of bitulithic paving have been awarded to the Warren Construction Co.

Portland, Ore.—Special.—Contracts aggregating 74,474 sq. yds. of bitulithic paving have been awarded to the Warren Construction Co.

Newcastle, Ind.—Special.—The Western Construction Co. has been awarded a contract for 4,406 sq. yds. of bitulithic paving in N. 11th st.

Baker City, Ore.—Special.—The Warren Construction Co. has been awarded an additional contract for 3173 sq. yds. of bitulithic paving.

York, Pa.—The Filbert Asphalt Co. was awarded contracts, Aug. 5, for paving Carlisle and Madison aves. with asphalt, at $1.78 a sq. yd.

Pasadena, Cal.—J. E. Haddock was awarded the contract for oiling, grading, curbs and gutters in Chester ave., for $6,622.

Portland, Ore.—Special.—The Warren Construction Co. has been awarded contracts aggregating 38,000 sq. yds. of bitulithic paving.

Peru, Ind.—Special.—The Western Construction Co. has been awarded a contract for 9280 sq. yds. of bitulithic paving in E. Main st.

Cincinnati, O.—The Kirchner Construction Co. was awarded the contract for improving Tafel st. with macadam and brick, for $6,842.

Canton, O.—William H. Vogt, of Massillon, was awarded a contract, Aug. 5, for paving 2.54 mis. of road in Sugar Creek twp., for $41,299.

New Orleans, La.—Special.—The contract for 3300 sq. yds. of bitulithic paving in Plum st. has been awarded to the Southern Bitulithic Co.

Baltimore, Md.—The contract for constructing 800 ft. of vitrified brick paving in Belair road was awarded to E. Parke Lindsay, for $60,000.

Dalles City, Ore.—Special.—The contract for 13,830 sq. yds. of bitulithic paving in 4th st. was awarded to the Warren Construction Co.

New Britain, Conn.—The contract for constructing 4150 sq. yds. of bitulithic paving in Main st. was awarded to Warren Bros. Co.

Puyallup, Wash.—Special.—The Warren Construction Co. has been awarded a contract for 8,198 sq. yds. of bitulithic paving in district No. 18.

Des Moines, Ia.—The Bryant-McLaughlin Asphalt Co. has been awarded a contract for 3671 sq. yds. of paving in 23rd st., at $2.05 a sq. yd.

Chicago, Ill.—The Citizens' Construction Co. was awarded a contract, Aug. 19, for paving La Salle st. with creosoted blocks, at $3.42 a sq. yd.

Bayonne, N. J.—Special.—The Standard Bitulithic Co. has been awarded a contract for 16,150 sq. yds. of bitulithic paving in Prospect ave.

Vancouver, B. C.—Special.—The contract for 52,126 sq. yds. of bitulithic paving has been awarded to the British Columbian Bitulithic Co., Ltd.

Robinson, Ill.—The contract for constructing 1½ mis. of paved streets was awarded, Aug. 2, to Keegan Bros., of Terre Haute, for $40,000.

Cottage Grove, Ore. — Special. — The Warren Construction Co. has been awarded a contract for 7200 sq. yds. of bitulithic paving in Main st.

Salem, Ind.—The contract for constructing the Bee Line gravel road was awarded to Bert Charteau, of Campbellsburg, Ind., Aug. 1, for $11,754.

Merchantville, N. J.—The contract for constructing an amiesite road .85 mis. in length was awarded, Aug. 10, to E. C. Humphrey, of Hackensack, N. J., for $12,114.

Tarentum, Pa.—Brown & Crissman, of Kittanning, Pa., secured the contract for macadamizing 2800 sq. yds. of driveways in the Kittanning cemetery.

Niagara Falls, N. Y.—The Read-Coddington Co. was awarded a contract, Aug. 2, for paving Buffalo ave. with Toledo asphalt block, for $72,923.

Rosedale, Kas.—The contract for constructing 2620 sq. yds. of bitulithic paving in Shawnee st. has been awarded to the Kansas Bitulithic Co., of Wichita.

New Britain, Conn.—The contract for constructing 4,510 sq. yds. of bitulithic paving in Main st. for the railroad area was awarded to Warren Brothers Co.

East Moline, Ill.—The Northwestern Construction Co., of Davenport, Ia., was awarded the contract for paving ¾ mi. of 13th st. with brick, for $15,279.

Escondido, Cal.—Denny & Granville secured the contract for grading and paving with decomposed granite, Grand ave., from Jumper to Nutmeg sts., for $6,400.

Jefferson Barracks, Mo.—The contract for constructing roads, walks, etc., was awarded to John B. Turner, Pierce Bldg., St. Louis, Mo., for $3,808.

Santa Monica, Cal.—Fred H. Stout, Fay Bldg., Los Angeles, has been awarded a contract for constructing concrete roads,

sidewalks and sewer system in Seaside Terrace, for $14,600.

St. Paul, Minn.—The General Contracting Co., of Minneapolis, was awarded the contract, Aug. 4, for repaving Dayton ave. with asphalt, for $40,000.

Cottage Grove, Ore.—The contract for paving the main business street with bitulithic was awarded to the Warren Construction Co., of Portland, at $2.35 a sq. yd.

Seattle, Wash.—The contract for improving 5th ave. and 5th ave. S. and other streets was awarded to Marker, Russell & Gallagher, for $156,144.

Salt Lake City, Utah.—Bids were submitted, Aug. 8, for paving extension No. 67 as follows: P. T. Moran, Salt Lake City, $191,724; Strange & McGuire, Salt Lake City, $196,413.

Holliston, Mass.—The contract for constructing 3¼ mis. of road was awarded, Aug. 2, to C. E. Horne, of Millbury, for $8,304 for the town work and $7,782 for the state work.

Monroe, Mich.—The contract for paving N. Macomb and Washington sts. with asphalt blocks was awarded, Aug. 15, to the Asphalt Block Co., of Toledo, O., for $17,365.52 and $13,683.16.

Watervliet, N. Y.—Michael W. Nolan was awarded a contract, Aug. 12, for paving Broadway with granite block on concrete base, at $1.39 a sq. yd.; curbing, 89 cts. a lin. ft.; catchbasins, $60 each.

Decatur, Ill.—Jansen & Zoller, of Pekin, Ill., was awarded a contract, Aug. 1, for 7975 sq. yds. of vitrified block paving on 4-in. concrete base, in Marietta st., for $18,156.

Pensacola, Fla.—The contract for constructing 525,000 sq. ft. of concrete sidewalks was awarded, Aug. 10, to W. W. Hatch Sons & Co., of Goshen, Ind., at 9 cts. a sq. ft.

Crowley, La.—The contract for constructing 5 mis. of cement walks in 28 different streets was awarded to DeJersey & Beinard, of Jennings, at 12.45 cts. a sq. ft.

Gulfport, Miss.—The bids submitted Aug. 2 for constructing about 13,000 sq. yds. of cement sidewalks were rejected, so as to allow the city to correct discrepancies in the ordinance.

Leetonia, O.—(Special.)—The contract for paving Columbia st. with Bessemer block, with asphalt filler, was awarded to J. G. McGuire & Co., of New Brighton, Pa., at $1.31 a sq. yd. and 48 cts. a lin. ft. for curbing.

Waynesboro, Pa.—H. B. Baker, of this city, was awarded a contract, July 30, for moving about 23,000 cu. yds. of material, of which about 7,000 cu. yds. will be limestone rock and the remainder soft shale and earth.

Los Angeles, Cal.—Contracts have been awarded as follows: Improving Isabel st., S. McCray, $12,364; Cornwell st., D. D. Chapman, $6,621; Rockwood st., Los Angeles Bridge & Construction Co.; Morton ave., T. E. Shafer, $15,801.

Decatur, Ala.—Contracts for grading, draining and macadamizing were awarded Aug. 9, as follows: Goodrich & Crinkley, of New Decatur, 5 mis., $18,309; A. G. Patterson, of Falkville, Ala., ½ mi., $4,965.

Chariton, Ia.—J. C. Blunk, of Ottumwa, was awarded a contract for paving N. Grand st. and the street leading to the depot, at $2.04 a sq. yd. for paving, 55 cts. for curbing, 45 cts. for excavating.

Wichita, Kans.—R. L. Bobbitt & Co. secured the contract for constructing a sand-clay road in Lawrence ave., for $5,330. The Kansas Bitulithic Co. was awarded a contract for 26,255 sq. yds. of bitulithic paving in Cleveland ave.

Pittsburg, Pa.—Contracts for permanent improvement of public roads and highways were awarded, Aug. 2, as follows: Duff City and Campmeeting roads, Foley Bros., $57,430; Pennysville extension No. 4, Henry Hileman, $27,982; Troy Hill extension, No. 2, Neelan & Daly, $11,141.

Mountain View, Tenn.—The contract for curbing Dandridge pike and E. Main ave. and laying 6,000 ft. of curbing was awarded to George W. West, at 24½ cts. a lin. ft.; paving above, West Construction Co., of Chattanooga, 71 cts. a sq. yd.

Brooklyn, N. Y.—The contract for grading, etc., in Parkside ave., was awarded, Aug. 11, to the Brooklyn Alcatraz Asphalt Co., 497 Hamilton ave., for $39,707. This company was also awarded a contract, Aug. 10, for paving a traffic road in Ocean Parkway, for $61,259.

Chehalis, Wash.—Contracts for bitulithic paving have been awarded to the Warren Construction Co., as follows: Dist. No. 74, 6,835 sq. yds.; No. 75, 6,195 sq. yds.; No. 76, 4,887 sq. yds.; No. 77, 4,478 sq. yds.; No. 79, 2,164 sq. yds.

Reading, Pa.—Contracts were awarded, Aug. 3, for constructing 27,550 sq. yds. of vitrified block paving and 1,850 sq. yds. of granite block paving, as follows: Fehr & O'Rourke, vitrified block paving, $39,890; granite block paving, John E. Weidner, $4,322.

Kansas City, Mo.—Bids were opened, Aug. 19, for paving Southwest boulevard and Askew ave. The lowest bid submitted was that of the Cleveland-Trinidad Co., of Cleveland, O., but it was rejected on account of the company's negligence in its maintenance on 19th st.

Wilmington, Del.—The Horrigan Contracting Co., of this city, was awarded contracts, Aug. 16, for constructing roads as follows: Telegraph road, Dyer trap rock, $14,598; State road, Dyer trap rock, $19,000; Lore ave., Brandywine granite, $5,624. The Corcoran Construction Co., West Chester, was awarded a contract for constructing Lancaster turnpike with local stone for $37,990.

Paterson, N. J.—John R. Lee, of this city, will pave the Public Service Railway Co.'s share of Park ave., for $32,000. The Empire City Construction Co., World Bldg., New York City, will pave the city's share for $60,000. American wood block, with Berea block curbing, will be the material used.

Boise, Idaho.—Contracts for constructing 60 blocks of asphalt paving and 30 blocks of concrete paving have been awarded as follows: Coast Construction Co., of Tacoma, Wash., 14 blocks concrete, $41,759; Jacob Gustafson, of Boise, 16 blocks concrete paving, $49,257; Pacific Construction Co., of Portland, 60 blocks asphalt, $223,124.

Sheboygan, Wis.—J. Rasmussen & Sons Co., of Oshkosh, was awarded a contract for paving 26,260 sq. yds. of S. Water st. with brick. The company's bid was as follows: Metropolitan brick, $1.83½; Peebles or Townsend, $1.85; 4-in. curb, 24-in., 55 cts.; 30-in., 65 cts.; resetting, 15 cts.

Morris, Ill.—Bids for paving 2 mis. of residence streets were submitted, Aug. 2, as follows: Edward M. Lanig, of Highland Park, $36,785; Joseph Hanreddy, Chicago, $35,964; Keyes & McNamara, La Salle, $32,673; George A. Peter, Sycamore, $31,913.

Galveston, Tex.—Bids for repairing the brick pavement in Market sts., were submitted, Aug. 5, as follows: S. C. Leonard, for taking up and relaying about 781 sq. yds. of paving, 74 cts. per sq. yd.; for about 30,000 vitrified brick, $24 per M. Kelso & Vautrin, for taking up and laying paving, 73 cts. per yd.; for brick, $23 per M.

Villisca, Ia.—(Special.)—Bids were submitted Aug. 3 for vitrified brick paving on concrete base, with concrete curb, as follows: Hamilton & Schwartz, Shenandoah, Ia.: Curb, 37 cts.; paving, $1.97; excess grading, 40 cts.; overhaul grading, 2 cts. Conroy & Wright, Harlan, Ia.: 40 cts., $2.05, 40 cts. and 2 cts. O'Farrell Construction Co., Dubuque, Ia.: 49 cts., $2.09, 45 cts., 10 cts. M. Ford, Cedar Rapids, Ia., 49 cts., $1.97, 38 cts., 1½ cts. Theodore S. De Lay is engr.

Peru, Ind.—Contracts for constructing gravel roads have been awarded, as follows: Peck & Taber, Rensselaer, Ind., $5,218; George M. Good, Frankfort, Ind., $4,444; James M. Little, Indianapolis, Ind., $2,225; John F. Curran, Greencastle, Ind., $3,226; Goff-Kleyla Construction Co., Tipton, Ind., $21,248; Modlin Bros., Marion, Ind., $7,700; James F. Pierce, Delphi, Ind., $7,300.

New York City.—Bids were submitted Aug. 9 for repaving Water st., Richmond Terrace and Richmond ave., in Richmond boro, with wood blocks, as follows: U. S. Wood Preserving Co., 165 Broadway, $14,-238; Barber Asphalt Paving Co., $16,801; Empire City Contracting Co., $15,545; Jos. Johnson's Sons, $15,193; Uvalde Asphalt Paving Co., $15,383. Bids were also submitted for asphalt block paving on concrete, in Cary and Norwood aves., as follows: Barber Asphalt Paving Co., $5,-180; Hastings Pavement Co., $4,503; repaving Richmond road with iron slag block on a sand bed, Uvalde Asphalt Co., 1 Broadway, New York City, $101,239; Joseph Johnson's Sons, $10,538; Quinroy Construction Co., $10,713; repairing number of streets with brick on concrete, gutters, etc., Joseph Johnson's Sons, $29,256; Quinroy Construction Co., $31,764; Dominick Bonnaci, $28,124; vitrified brick paving on concrete foundation, Tompkins st., Oakland ave., Pennsylvania and other streets and avenues: Quinroy Construction Co., $19,450; Joseph Johnson's Sons, $17,925; Dominick Bonnaci, $18,251; C. Vanderbilt, $20,001.

Memphis, Tenn.—Contracts have been awarded as follows: For improving Latham st., from Iowa ave. to the Speedway, tar macadam paving, Roper & McTighe, $21,819; improving Waldran boulevard, from Poplar ave. to the Speedway, tar macadam paving, F. W. Jordan Contracting Co., $21,695; improving Cooper ave., from Madison to Central aves., asphalt paving, H. P. Streicher & Co., $42,763; improving Cleveland st., from Peabody to Harvard aves., resurfacing with tar macadam, E. J. Wetterstrom, $3,096; improving Cleveland st., from Peabody ave. to Poplar ave., tar macadam, Tennessee Road Co., $9,505; improving Wisconsin ave., from Kansas st. to Riverside boulevard, tar macadam, Roach & Manigan, $8,828; improving Chelsea ave., from 4th st. to the city limits, concrete paving, E. J. Wetterstrom, $27,170.

Columbus, O.—Bids for paving 11 streets and building several sewers were submitted, Aug. 3, as follows: Perry st., between King ave. and Eighth st., S. T. Knight, tar filler $4,317, cement filler $4,-277, asphalt filler $4,735; H. J. Shaw, $4,360, $4,280 and $4,580; Geigle, Garnes & Co., $4,233, $4,173 and $4,533; Budd & Bartling, $4,527, $4,407 and $4,-627; G. W. Patterson & Son, $4,201, $4,-161 and $4,401; John C. Beasley, $4,217, $4,197 and $4,417. Lazell st., from Mount st. to Sycamore st., H. J. Shaw, $11,291, $11,250 and $11,814; William M. Graham, $12,089, $11,948 and $12,653; John C. Beasley, $11,633, $11,586 and $12,056; Geigle, Garnes & Co., $11,046, $10,905 and $12,033. Harrison ave., from Second ave. to Fifth ave., Geigle, Garnes & Co., $12,-670, $12,493 and $13,024; Budd & Bartling, $14,005, $13,650 and $14,300; George W. Patterson & Son, $12,437, $12,555 and $13,145; John C. Beasley, $12,-905, $12,884 and $13,495.50; H. J. Shaw, $13,093, $12,857 and $13,624; S. T. Knight, $12,497, $12,379 and $13,854. Abbott ave., from Bryden road to Main st., Geigle, Garnes & Co., $7,798, $7,720 and $8,240; H. E. Barthman, tar filler $7,557, asphalt filler, $7,817; John C. Beasley, tar filler $8,159, cement filler $8,133, asphalt filler $8,419; A. G. Pugh, $8,499, $8,519 and $8,599. Sixth ave., from High st. to Wesley ave., Geigle, Garnes & Co., $3,810, $3,762 and $4,050; Budd & Bartling, $3,-837, $2,741 and $3,917; George W. Patterson & Son, $3,607, $3,576 and $3,768; John C. Beasley, $3,798, $3,782 and $3,-942; H. J. Shaw, $3,664, $3,616 and $3,-824. Frankfort st., from Mohawk st. to Sixth st., William M. Graham, $5,-005, $4,975 and $5,155; Geigle, Garnes & Co., $4,731, $4,686 and $4,956. Wolfel st., from Beech st. to Parsons ave., Geigle, Garnes & Co., $5,452, $5,382 and $5,852; William M. Graham, $5,678, $5,584 and $5,913; H. J. Shaw, $5,602, $5,531 and $5,813. Third st., from Moler st. to Southwood ave., Geigle, Garnes & Co., $7,-960, $7,871 and $8,441; Budd & Bartling, $8,103, $7,923 and $8,253; William M. Graham, $7,654, $7,564 and $8,164. Twenty-second st., from Livingston ave. to Columbus st., Geigle, Garnes & Co., $11,913, $11,805 and $12,417; H. E. Barthman, tar filler $11,560, asphalt filler $11,920; William M. Graham, tar filler $12,568, cement filler $12,496, asphalt filler $13,036; A. G. Pugh, $12,842, $12,859 and $12,910. Ludlow st., from Chestnut st. to Randolph st., Geigle, Garnes & Co., $3,158, $3,113 and $3,398. Sewer in Fairmont ave., Geo. F. Ames, $8,886; J. O. Jones, $7,002; John C. Beasley, $10,230.

St. Louis, Mo.—Contracts for paving have been awarded, as follows: Pacific ave., Hiram Lloyd Building and Construction Co., brick, $1,569.78; Arsenal st., Webb-Kunze Const. Co., brick, $37,183.80; Minnesota, Ruecking Const. Co., brick, $8,362.52; Twenty-first, Daniel Murphy, brick, $12,789.74; McRee, Fruin-Bambrick Const. Co., brick, $37,186.30; Lemp, Ruecking Const. Co., brick, $6,168.30; Twenty-first, Daniel Murphy, brick, $10,-359.02; Bulwer ave., Daniel Murphy, brick, $10,456.25; Victoria ave., Hiram Lloyd Building and Const. Co., brick, $13,-685.38; Crittenden, Fruin-Bambrick Const. Co., brick, $1,732.90; Duncan ave., Fruin-Bambrick Const. Co., brick, $8,995; Alaska ave., Ruecking Const. Co., brick, $15,778; Campton, G. Eyermann & Bro., brick, $5,905.28; Bertha, Heman Const. Co., brick, $2,839.82; Idaho ave., G. Eyermann & Bro., brick, $27,232.68; Juniata st., Hiram Lloyd Building and Const. Co., brick, $19,526.20; Alabama ave., Hiram Lloyd Building and Const. Co., brick, $9,-724.50; Twenty-third st., Daniel Murphy, brick, $2,793.99; Maiden Lane, Daniel Murphy, brick, $5,198.35; Natural Bridge, Fruin-Colnen Const. Co., brick, $27,-412.80; St. Louis ave., Hiram Lloyd Bldg. and Const. Co., brick, $10,754.96; Greer, Bambrick Bros. Const. Co., brick, $4,-243.86; Minnesota, G. Eyermann & Bro., brick, $6,705.96; Natural Bridge, Fruin-Colnen Const. Co., brick, $4,172.70; Glasgow, Harry F. Heman, $17,952.95; Twentieth, Jas. E. Perkinson, brick, $24,890.46; Twentieth, Wm. H. Redemeyer, $9,059.08; Twentieth, Skrainka Const. Co., brick, $52,255.90; Twentieth, Wm. H. Redemeyer, brick, $11,258.90; Arsenal, Granite-Bituminous Paving Co., macadam, $25,-294.68; Portis, Granite-Bituminous Paving Co., macadam, $9,512.21; Bent, Granite-Bituminous Paving Co., macadam, $13,505; Semple, Granite-Bituminous Paving Co., macadam, $21,272.24; Union,

Granite-Bituminous Paving Co., macadam, $27,650.79; Waldemar, Webb-Kunze Construction Co., telford, $3,773.40; McPherson, Kingshighway, Union boulevard, G. Eyermann & Bro., wood block, $27,466.43; Gay st., G. Eyermann & Bro., wood block, $2,388.40; Twelfth, G. Eyermann & Bro., wood block, $25,437.74; Twelfth, Granite-Bituminous Paving Co., wood block, $31,-168.40.

SEWERS.

CONTEMPLATED WORK.

Essex, Ia.—This town voted to construct a sewerage system.

Tekoa, Wash.—The installation of a sewerage system is contemplated.

Salina, Kans.—The construction of several sewers is contemplated.

Willmar, Minn.—Voted to issue bonds for constructing a sewerage system.

Greenville, Ia.—Plans have been completed for constructing a sewerage system.

Pleasant Ridge, O.—A sewerage system and sewage disposal plant is contemplated.

Phoenix, Ariz.—Voted to issue bonds for installing a sewerage system. Frank Thomas, cy. recdr.

Albion, N. Y.—Plans and surveys are being discussed for the proposed new sewerage system.

Olympia, Wash.—The city engineer estimates the cost of constructing a sewer in the 5th ward, at $18,000.

St. Joseph, Mo.—Ordinances have been passed for constructing sewers in districts Nos. 22 and 40.

Delaware, O.—Resolutions have been adopted for constructing sewers in Liberty and N. Sandusky sts.

Garnett, Mo.—Bids will be received shortly for constructing sewers and sewage purification works.

Yorkville, N. Y.—Plans and specifications have been adopted for constructing sewers. Bd. trustees.

Bellefontaine, O.—Contracts will probably be awarded about Oct. 25 for constructing a sewerage system.

West Duluth, Minn.—A petition is being circulated for a sewer in Coates st., between 35th and 37th aves., West.

Ellensburg, Wash.—The city council has decided to construct the Southeast sewerage system at a cost of $12,000.

Annapolis, Md.—A commission will be appointed to devise plans and ascertain the cost of constructing a disposal plant.

Helena, Mont.—City Engineer Helmick estimates the cost of constructing an outflow sewer in the Broadwater addition at $7,380.

Fremont, Neb.—The citizens have petitioned for the extension of the sewerage system into the northwestern yart of the city.

Wapello, Ia.—The establishment of drainage district No. 13 is contemplated by the supervisors of Muscatine and Louisa counties.

East Moline, Ill.—A plan has been submitted to council for constructing 6 mls. of sewer mains in East Moline, at a cost of about $20,000.

Wichita, Kans.—Preliminary surveys have been completed for extending the city drainage canal to the Big Arkansas river, and bids will soon be asked.

Joplin, Mo.—Plans and specifications have been prepared for constructing a sewer system at an estimated cost of about $60,000. J. B. Hogddon, cy. engr.

Monrovia, Cal.—Plans have been prepared for constructing a complete sewerage system, and the question of issuing bonds will be voted on about Oct. 1.

Clinton, Ia.—(Special.)—R. C. Hart, cy. engr., has been directed to prepare plans and estimates for constructing sewers in ditsricts Nos. 3 and 4.

Birmingham, Ala.—Plans will be prepared and bids asked soon for constructing the big septic tank for this city on Cillage creek, near Easley. L. M. Satter, co. san. engr.

Caldwell, N. J.—A sewerage system is contemplated.

Annapolis, Md.—A sewage pumping plant is contemplated.

Columbus, Miss.—The construction of storm sewers is contemplated.

Toccoa, Ga.—Voted to issue bonds for constructing a sewerage system.

Erie, Pa.—A storm water sewer system in the 6th ward is contemplated.

Harrisburg, Pa.—Plans are being prepared for constructing sewers this year.

Williamsport, Pa.—Plans are being prepared for constructing a storm sewer.

Golden, Colo.—Plans have been completed for constructing sewers in sanitary dist. 2.

East Liverpool, O.—Sewers will be built in Avondale, Calcutta, Bank, Oak and other streets.

West Chester, Pa.—Council is considering the question of constructing a sewerage system.

Waupaca, Wis.—Preliminary plans for constructing a sewerage system and septic tank are being made.

Pleasanton, Kas.—Bids will be asked shortly for constructing sewers and sewage purification plant.

Tuscaloosa, Ala.—Objections will be heard Sept. 22 on the proposed construction of sanitary sewers.

Govans, Md.—The Baltimore county commissioners are considering the question of extending the sewer mains.

Texarkana, Ark.—The construction of a sewerage system in a district comprising 33 streets is contemplated.

Lancaster, O.—Bids will probably be received in November for constructing sewers on the west side. John N. Wolfe, cy. engr.

Cincinnati, O.—The village of Kennedy Heights is considering an expenditure of $150,000 for constructing a sewerage system and disposal plant.

Martinsburg, W. Va.—Calvin W. Hendrick, ch. engr. sewerage comn., will estimate the cost of a sewerage system and disposal plant.

Circleville, O.—The construction of storm water sewers at a cost of $4,500, and sanitary sewers at a cost of $15,000, is contemplated.

Morrillton, Ark.—The board of improvement, sewer dist. No. 1, will sell $25,000 6 per cent. sewer improvement bonds Sept. 15. M. A. Metzger, secy.

Norfolk, Va.—The city engineer has been directed to prepare estimates of the cost of installing sewers in Fauquier and Louisa sts., in Berkley ward.

Jeffersonville, Ind.—A resolution has been adopted for constructing a sewer in Pearl st. with branches in Maple, Chestnut and Market sts. V. W. Lyons, cy. engr.

Muskogee, Okla.—A committee has been appointed to investigate and report on the improvement of the sanitary sewer and sewage disposal plant. A. H. McGarr, mayor.

Bellevernon, Pa.—This borough, Bellevernon, Charleroi, Monessen, Donora, North Charleroi and Webster are considering the question of constructing a joint sewage disposal system.

Centerville, Md.—Bids are asked until Sept. 5 for constructing 12,500 ft. 8, 10

and 12-in. sewers; 2,400 ft. house connection, and 45 manholes. Bd. town comrs.

Omaha, Neb.—Bids are asked until Sept. 6 for constructing sewers. Dan. B. Butler, cy. clk.

Brawley, Cal.—Bids are asked until Sept. 19 for constructing a sewerage system. W. H. Whelan, cy. clk.

East Milwaukee, Wis.—Bids are asked until Sept. 7 for constructing sewers. Theodore B. Olson, vil. clk.

Grand Forks, N. D.—Bids are asked until Sept. 5 for building a lateral sewer in Oak st. Chas. J. Evanson, cy. audt.

Olean, N. Y.—Bids are asked until Sept. 13 for constructing a vitrified pipe sewer and appurtenances in Main st. Comrs. pub. wks.

Greenville, S. C.—Bids are asked until Sept. 10 for constructing 6 mis. of 8-in. sanitary extensions, etc. C. P. Ballenger, cy. engr.

Newburg, O.—Bids are asked until Sept. 17 for constructing sewer and water mains in a number of streets. J. W. Shimek, cy. clk.

Carrington, N. D.—Bids are asked until Sept. 9 for constructing a septic tank, main outlet and certain sewers in sewer dist. No. 1. Cy. coun.

Massillon, O.—Bids are asked until Sept. 3 for building a sanitary sewer in 3rd, Thorne and Water sts. Wm. A. Pietzoker, dir. pub. service.

Emmetsburg, Ia.—Bids are asked until Sept. 6 for constructing 2,987 ft. 8-in. vitrified sewer in Broadway, 14th, Union and 16th sts. T. E. Rutledge, cy. clk.

Indianapolis, Ind.—Bids are asked until Sept. 7 for constructing sewers in McPherson and Bellefontaine sts., Euclid ave. and an alley. C. A. Schrader, chm. B. P. W.

Clarion, Ia.—Bids are asked until Sept. 12 for cleaning out and deepening ditches No. 3 and 5, near Galt. E. M. Callender, co. audt.

North Braddock, Pa.—Bids are asked until 3 p. m., Sept. 2, for constructing a terra cotta pipe sewer in Main st. with 1 manhole and 1 lamphole. C. A. Stewart, boro. engr.

Owosso, Mich.—Bids are asked until Sept. 8 for constructing 1,600 ft. 24-in., 880 ft. 20-in. and 500 ft. 15-in. sewers; 80 6-in. Y branches, 12 manholes, 1 special catch-basin inlet for flushing. E. F. Joslin, engr. in ch.

CONTRACTS TO BE LET.

Emmetsburg, Ia.—Bids are asked until Sept. 6 for constructing sewers in 14th, Union, 16th and Broadway sts. T. E. Rutledge, cy. clk.

Sioux Falls, S. D.—Bids are asked until Sept. 6 for constructing 66,000 ft. 8 to 36-in. sewers. Bd. co. comrs.

Newcastle, Ind.—Bids are asked until Sept. 5 for constructing 1½ mi. of trunk sewer. W. Q. Freel, cy. engr.

Algona, Wis.—Bids are asked until Sept. 1 for constructing a vitrified pipe sewer. Wm. Neseman, Jr., cy. clk.

Cynthia, Ky.—Bids are asked until Sept. 13 for constructing a sewer in Battle Grove ave. J. A. Dougherty, clk.

Sioux Falls S. D.—Bids are asked until Sept. 6 for constructing a trunk sewer on the West Side. Lewis Larson, cy. audt.

West View, Pa.—Bids are asked until Oct. 1 for constructing main sewers and a disposal plant. H. L. Donaldson, secy. boro.

Louisville, Ky.—Bids are asked until Sept. 2 for constructing section F of the Beargrass intercepter contract No. 73. J. B. F. Bread, engr. sewerage comn.

Evansville, Wis.—Bids are asked until Sept. 6 for a supervising engineer to supervise and look after the installation of a sewage plant. F. W. Gillman, cy. clk.

Union City, Ind.—Bids are asked until Sept. 5 for constructing a main sewer, branch and lateral sewers, connections and appurtenances. Ross C. Sutton, cy. clk.

Newburg Heights (Cleveland P. O.), O. —Bids are asked until Sept. 3 for constructing sewers in Alpha, Beta and Bridgeview aves. and Cuyahoga and other streets. A. W. Shatts, vil. clk.

Clarion, Ia.—Bids are asked until Sept. 5 for constructing a sewage settling tank and 6 in. outlet sewer from the tank to the storm sewer in street. M. F. Birdsall, secy. school bd.

Saskatchewan, Sask.—Bids are asked until Sept. 8 for all work in connection with sanitary and storm sewer and sewage disposal work for the buildings and grounds of the univerhity. Prest. university.

Baltimore, Md.—Bids are asked until Sept. 7 for constructing 23,000 lin. ft. 8 to 15 in. vitrified sewers, 30 ft. 30 in. brick and concrete sewer, and 10,000 ft. 6 in. house connections, and erecting a coal and ash handling plant in the sewage pumping station building. W. D. Platt, chmn. pro tem. sewerage comn.

CONTRACTS AWARDED.

Alameda, Cal.—The contract for constructing the south side sewer was awarded to F. H. Dahnke.

Clinto, Ia.—The contract for constructing a sewer was awarded to the Clarke Construction Co., for $1,452.15.

Dallas, Tex.—The contract for constructing the deep sewer in Elm st. was awarded, Aug. 17, to the Dallas Lime & Gravel Co., for $3,455.

Burlington, Ia.—The contract for constructing a drainage system was awarded to Richard Runell, of Oakville, for about $30,000.

South Haven, Mich.—The contract for constructing 4,000 ft. of 8 and 10-in. sewers was awarded to the Swanson Co., 834 N. Cloud st., Chicago.

Haddon Heights, N. J.—The contract for constructing a sewerage system and disposal plant was awarded to B. F. Sweeten & Son, for $56,000.

Mars, Pa.—The contract for constructing 13,344 ft. 8-in. and 2,368 ft. 10-in. sewer was awarded, Aug. 9, to Wm. Jones, of Carnegie, for $15,800.

Brookville, Ind.—The contract for constructing a sanitary sewer in N. Main st. was awarded to Dudley & Keough, of this city, for $3,426.30.

St. Louis, Mo.—The Hoffman-Hogan Construction Co. was awarded a contract for constructing the Dale ave. sewer for $75,157.41, and the contract for the Ellendale sewer was awarded to Clarke & Ansbro, for $27,125.75.

Erie, Pa.—F. J. Eichenlaub was awarded a contract for reconstructing the 9 and 12-in. lateral sewers in W. 12th st., at the following prices: 12-in. pipe, 90 cts. a foot; 9-in. pipe, 80 cts. a foot; 6-in. pipe, 40 cts. a foot; 12x9x6-in. Y or T branch, $1.10; manholes, $35.

Philadelphia, Pa.—Contracts for constructing a sewage disposal plant were awarded, Aug. 10, as follows: Pumping station, $16,200, and disposal plant, $61,356, Costello & Co.; erecting a power plant in connection with the pumping station, to the Keystone State Constructing Co., $17,350; building intercepting sewer from Frankford ave. to Pennypack creek, Edwin H. Vare, $43,000.

WATER WORKS.

CONTEMPLATED WORK.

Colbran, Colo.—A water works system is contemplated.

Mt. Blanchard, O.—A water works system is contemplated.

Milford, Neb.—A water and light plant is contemplated.

Fairbury, Neb.—The construction of a standpipe is contemplated.

Warrenton, Mo.—Voted to issue bonds for a water works and sewerage system.

Brunswick, Md.—Voted to issue $5,000 bonds for water works extension.

Yukon, Okla.—The construction of a water works system is contemplated.

Ontario, Cal.—Plans for a municipal water works system is contemplated.

Farmington, Minn.—Voted to issue $10,000 for constructing a water works system.

Broken Bow, Neb.—Voted to issue $17,000 bonds for extending the water mains.

Santa Ana, Cal.—Will vote on the issue of bonds for a new water works system.

Meriden, Conn.—The water service is to be extended to Cherry Hill water dept.

Mannsville, Okla.—Voted to issue $20,000 bonds for constructing a water works system.

Lynn, Mass.—A site has been decided upon for the proposed new mechanical filtration plant.

Mannsville, Okla.—Voted to issue bonds for constructing a water works system.

Mulvane, Kans.—Voted to issue bonds for constructing a new water works system.

Onaya, Minn.—Plans and specifications are being made for a water works system.

La Plata, Mo.—Bids will be asked in October for constructing a water works system.

South Charleston, O.—The question of erecting a water works plant is being agitated.

New Carlisle, O.—Will vote in September on the issue of bonds for a water works system.

Rockmart, Ga.—Voted to issue $35,000 bonds for constructing a water works system.

Albertville, Ala.—Voted to issue $25,000 bonds for constructing a water works system.

Steubenville, O.—The installation of a new water works system is contemplated. T. Porter, engr.

New Athens, Ill.—The constructing of a new water works system by general taxation is contemplated.

Vallejo, Cal.—Will vote in October on the issue of $90,000 bonds for water works improvements.

Saginaw, Mich.—Will vote Sept. 6 on the issue of bonds for constructing a municipal water works system.

Muskogee, Okla.—A committee has been appointed for constructing a water works system. A. L. McGare, mayor.

Spokane, Wash.—The extension of the water mains, at a cost of about $100,000, is contemplated. Mayor Pratt.

Floresville, Tex.—An additional engine and air compressor may be purchased for the water works plant.

East Peoria, Ill.—A committee has been appointed to investigate the cost of installing a water works system.

Cleveland, O.—The construction of a submerged intake for the new 9-ft. tunnel is contemplated.

New Carlisle, O.—Will vote Sept. 27 on the issue of bonds for constructing a water works system.

Hettinger, N. D.—Plans and specifications have been completed for installing a water works system.

Springfield, Mo.—Petitions are being circulated asking for municipal ownership of a water works system.

Austin, Minn.—Bids will be asked about Sept. 1 for constructing extensions to the water works system. Wm. Todd, cy. engr.

Bristol, Pa.—The state board of health has granted this city permission to establish a municipal water works system.

Hearne, Tex.—C. L. Dillard and W. A. Wilkinson have been appointed a committee to secure a water works system.

Cleveland, O.—Director Lee, of the public service, is in favor of the purchase of 2 engines for the Kirtland pumping station.

Marquette, Mich.—The question of constructing a hypochlorite of lime purification plant is under consideration.

Monroe City, Mo.—Plans and specifications have been completed and bids will be asked next spring for constructing a water works system.

La Crosse, Wis.—The erection of a new pumping plant at the La Crosse river in Levee Park, at a cost of $25,000 is contemplated.

mittee has recommended the creation of a water commission to locate an adequate water supply.

Chicago, Ill.—(Special.)—Lee Stenger, 508 S. Green st., desires to sell two Worthington duplex pumps, brass-lined cylinder.

David City, Neb.—Bids will be asked in September for constructing water extensions and a new light plant. John Martz, cy. engr.

Lansdowne, Pa. — (Special.) — A. E. Jones desires to purchase one Worthington pump, 12x18½x10½x10 in., in good condition.

Ogdensburg, N. Y.—A resolution has been passed providing for the issue of $175,000 bonds for installing a filtration plant. Bd. of ald.

New Philadelphia, O.—Voted to issue $130,000 bonds for the purpose of purchasing the water works plant now owned by a company in this city.

Clinton, Ia.—(Special.)—A. C. Hart, cy. engr., has been directed to make plans and estimates for a water works system. W. E. Hayes, cy. clk.

Oakley, Kans.—Plans and specifications have been completed and bids will be asked as soon as the plans are approved by the state board of health for a water works system.

Clarksburg, W. Va.—The water and sewerage board has submitted a report recommending changes and additions to the present system, to make it adequate for the needs of the city.

Winchendon, Mass.—The board of water commissioners has decided to drive a new well as an emergency addition to the water supply. Wm. F. Clark, supt.

Pittsfield, Mass.—The special water committee submitted its report, Aug. 12, recommending the expenditure of $458,000 for increasing the water supply. Wm. H. Swift, chmn.

Oshkosh, Wis.—The committee appointed to investigate the advisability of purchasing the water works and conducting the plant under municipal ownership reported in favor of the step at the last meeting of the council.

Tama, Ia.—(Special.)—C. A. Baughman, cy. engr., says this city desires to communicate with firms that would figure on an automatic sewage lift, comprising centrifugal pump, water wheel and automatic regulating nozzle.

CONTRACTS TO BE LET.

Carrington, N. D.—Bids are asked until Sept. 9 for extending the water mains. Cy. coun.

Detroit, Mich.—Bids are asked until

Sept. 20 for building a pumping engine. B. F. Guiney, secy. bd. water comrs.

Kewanee, Ill.—Bids are asked until Sept. 6 for replacing certain water mains. O. D. Peterson, cy. clk.

Anamosa, Me.—Bids are asked until Sept. 10 for drilling wells at the county farm. Louis Gardner, co. audt.

Cleveland, Miss.—Bids are asked until Sept. 6 for constructing a water works plant. X. A. Kramer, cons. engr., Magnolia, Miss.

Grand Forks, N. D.—Bids are asked until Sept. 5 for remodeling and reconstructing the present slow sand filter. H. G. Lykken, cy. engr.

Albany, N. Y.—Bids are asked until Sept. 7 for constructing a reservoir and dam on the West Canada creek. F. C. Stovers, supt. public works.

Evansville, Ind.—Bids are asked until Sept. 29 for furnishing and erecting 2 steam-driven pumps or pumping engines. H. L. Heilmann, secy. water bd.

Conneaut Lake, Pa.—Bids are asked until Sept. 5 for laying 9,800 ft. of 4 and 6-in. water mains, setting 17 hydrants and 16 valves. T. F. Armour, boro clk.

Arapaho, Okla.—Bids are asked until Sept. 6 for the purchase of all material required in constructing a water works and electric light plant. M. C. Main, mayor.

Grand Rapids, Mich.—Bids are asked until Sept. 8 for constructing basins and substructures of the buildings for the filtration plant. Henry J. Klevorn, prest. B. P. W.

Greeley, Colo.—Bids are asked until Sept. 10 for the enlargement and improvement of the lower Latham reservoir dam. P. A. Hartung, engr. bd. directors Lower Latham Reservoir Co.

Montreal, Que.—Bids are asked until Sept. 14 for work to be done in the River St. Lawrence, at entrance of aqueduct, to include furnishing and laying pipe, constructing concrete fill, etc. Bd. co. comrs.

Portland, Me.—Bids are asked until Sept. 12 for furnishing and laying 14 mis. of pipe, requiring 75,700 ft. 48-in. steel pipe, 21,600 tons c. i. pipe, 300 tons specials, etc. L. B. Griffin, chmn. trustees water dist.

Waterboro, Wis.—Bids are asked until Sept. 6 for constructing a reservoir, building concrete foundation for steam pumps, laying 18,000 ft. 4, 6, 8 and 10-in. water mains, and setting fire hydrants, valves and valve box. Bd. trustees.

Pella, Ia.—Bids are asked until Sept. 6 for constructing a combined water and light plant, requiring 18,000 ft. 10-in. pipe, filter gallery, well, 2 buildings, etc. A. C. Kuyper, cy. clk.; Iowa Engineering Co., cons. engrs., Clinton, Ia.

CONTRACTS AWARDED.

Orangeville, Ill.—The contract for a new water tower was awarded to Willoughby Bear, for $1,813.

Milwaukee, Wis.—The Advance Construction Co. was awarded the contract for laying 18,000 ft. of water pipe.

Rugby, N. D.—The contract for extending the water works system was awarded to L. W. Schruth, of Fargo, for $11,327.

Alliance, Mo.—The contract for the extension of the water works system has been awarded to the Katz-Craig Construction Co., of Omaha, for $19,200.

Ada, Okla.—The contract for constructing a water works system was awarded to C. A. Rees, of Tahlaquah, Okla.

Dundee, Ill.—The contract for extending the water works system of East Dundee was awarded to T. H. Inglehart, of Chi-

Weston, Ore.—The contract for water works improvement was awarded to J. L. Frankman, of Walla Walla, for $3,370.

Grand Valley, Colo.—The contract for constructing a water works system was awarded to D. G. Gordon, for $36,000.

Johnstown, Colo.—The contract for installing a water works system was awarded to Fairbanks, Morse & Co., for about $12,000.

Batavia, N. Y.—The contract for a concrete dam was awarded to the Herbert Engineering Co., of Easton, Pa., for $6,-100.

Denver, Colo.—The Holme & Allen Pipe and Construction Co. was awarded the contract for laying pipe and making repairs to the distributing system of the old South Denver plant, for $14,142.

Utica, O.—Contracts for installing a municipal water works system were awarded, Aug. 20, as follows: Pumping machinery, Weinman Pump Sup. Co., Columbia; c. i. pipe, U. S. Cast Iron Pipe & Foundry Co., of Columbus; work of installation, Cantrell Construction Co.

Gadsden, Ala.—The contract for constructing a new water plant has been awarded as follows: Casey-Hedges Co., Chattanooga, contract for boilers; Henry R. Worthington Co., New York, contract for pump, water heater and turbo-centrifugal engine; Laidlaw, Dunn, Gordon & Co., New York, contract for 3,000,000-gallon pump; General Contracting and Construction Co., Atlanta, contract for general construction and filters.

BRIDGES.

Williston, S. D.—Bids are asked until Sept. 7 for building bridges. Bd. co. comrs.

Rockport, Ind.—Bids are asked until Sept. 8 for building 7 bridges. John F. White, co. audt.

Lebanon, Ind.—Bids are asked until Sept. 8 for building 6 bridges. B. F. Herdrick, co. audt.

Carthage, Mo.—Bids are asked until Sept. 7 for constructing 4 bridges. Wm. Kohlman, co. highway engr.

Jasper, Ind.—Bids are asked until Sept. 6 for constructing 10 bridges. N. A. Sweeney, co. audt.

Leavenworth, Kas.—Bids are asked until Sept. 5 for building McQuillen bridge. J. W. Mehaus, co. clk.

Fargo, N. D.—Bids are asked until Sept. 9 for constructing a number of bridges. Arthur C. Lewis, co. audt.

Akron, O.—Bids are asked until Sept. 2 for repairing Portage st. bridge at Cuyahoga Falls. C. L. Wirth, co. clk.

Delaware O.—Bids are asked until Sept. 6 for building a bridge. W. H. Bodrutha, co. audt.

Frederick, Okla.—Bids are asked until Sept. 7 for constructing 14 steel bridges. John B. Darden, co. clk.

Bismark, N. D.—Bids are asked until Sept. 7 for constructing 2 steel bridges. I. W. Healy, co. audt.

Stillwater, Okla.—Bids are asked until Sept. 6 for building a steel bridge across the Cimarron river. Co. clk.

Augusta, Me.—Bids are asked until Sept. 9 for building a bridge over St. Johns river at Van Buren. State Comr. Highways.

Lima, O.—Bids are asked until Sept. 13 for erecting a steel bridge over Hog creek. C. R. Phillips, clk. co. comrs.

Crown Point, Ind.—Bids are asked until Sept. 7 for building a wooden bridge in Deep river. Chas. A. Johnson, co. audt.

Clinton, Ia.—Bids are asked until Sept. 13 for constructing a culvert or

bridge at Main and Spring sts. W. E. Hayes, cy. clk.

Albany, N. Y.—Bids are asked until Sept. 7 for constructing a new highway bridge over Erie canal. F. C. Stevens, supt. pub. wks.

Gaffney, S. C.—Bids are asked until Sept. 5 for constructing the steel approaches on concrete base, repairing bridge, etc. E. Felix Lipscomb, co. engr.

Columbus, O.—Bids are asked until Sept. 14 for encasing in concrete the east abutment of the Dublin bridge over the Scioto river. F. M. Sayre, co. audt.

Harrisburg, Pa.—Bids are asked until Sept. 16 for constructing a cement masonry bridge on the National Road. Jos. W. Hunter, State highway comr.

Wilkes Barre, Pa.—Bids are asked until Sept. 8 for constructing 7 river piers; 6 steel river spans; reinforced concrete viaduct, etc. Jas. M. Norris, co. controller.

Ashland, O.—Bids are asked until Sept. 7 for building 2 steel truss bridges with concrete floor and 2 new substructures of stone and concrete. T. Brindle, co. surv.

Cincinnati, O.—Bids are asked until Sept. 9 for constructing a bridge in Brierly creek rd.; until Sept. 16 for building a concrete bridge over Toad creek. Stanley Struble, prest. co. comrs.

STREET LIGHTING.

Magnolia, Ia.—An electric light system is contemplated.

Terrill, Tex.—Voted to issue bonds for electric light plant.

Thibodaux, La.—Plans have been accepted for an electric light plant.

Rutherfordton, N. C.—Voted to issue bonds to install electric light plant.

Franklin, Neb.—Will vote on the issue of bonds for erecting an electric light plant.

Vandalia, Ill. —Voted to issue bonds for repairs to the municipal electric light plant.

Victoria, Tex.—The Victoria Mfg. Co. has been awarded a contract for lighting this city with electricity.

Mapleton, Ia.—The Mapleton Gas Co. has been reorganized by J. E. Duschl, M. J. Goldberger and C. C. Jacobson.

Princeville, Ill.—Bids are asked for Sept. 3 for a municipal light plant. Will grant franchise. Vil. clk.

Culver, Ind.—The business men and residence owners have petitioned the town board for street lights.

Sacramento, Cal.—The South Sacramento Power Co. has been incorporated by H. W. Conger, Fred Ferheart, Robt. Lewis and others.

Baltimore, Md.—A report has been submitted for the cost of constructing the municipal lighting plant. B. T. Fendall, cy. engr.

Moberly, Mo.—(Special).—Al. P. Overman contemplates the establishment of a municipal gas plant and desires information along this line.

Birmingham, Ala.—The Birmingham Light and Power Co. was awarded the contract for arc lights for 5 years at $70 per light per year.

Bloomfield, N. J.—Residents of this city are considering the advisability of organizing an electric light company to light the city.

New Albany, Ind.—The contract for lighting the streets for 10 years was awarded to the United Gas and Electric Co. $55.44 per lamp per year.

What Cheer, Ia.—The city desires to contract for lighting the streets of this city. The present contract expires in Nov. W. I. Meade, mayor.

Eldoran, Wis.—The Eldoran Light and Power Co. has been incorporated by Arthur J. Plowman, August M. Olsen and Louis M. Jacobson, Terrell, Tex.

Newark, N. J.—A contract for installing electric light and power plant in the court house was awarded, Aug. 11, to the Watson-Flagg Engineering Co., for $26,500.

Charlottetown, P. E. I.—Bids are asked until Sept. 10 for supplying the city with electric light current for street and commercial purposes. W. C. Clarke, cy. clk.

Houston, Tex.—Bids are asked until Sept. 12 for the construction of a mechanical laboratory and power house for the William M. Rice Institute. E. Raphael, secy. Wm. M. Rice Inst.

New Britain, Conn.—The construction department of the Safety Insulated Wire and Cable Co. has been awarded a contract for laying electrical underground conduits for approximately $14,050.

Pella, Ia.—Bids are asked until Sept. 6 for constructing a combined light and water plant, requiring 2 a. c. generators, 2 motors, 2 engines, 2 pumps, 3 boilers, transmission line, city lighting lines, lamps, etc. A. C. Kuyper, cy. clk.; Iowa Engrg. Co., cons. engrs., Clinton.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Irvington, N. J.—Chas. Wahlers has been awarded the scavenger contract for $19,245.

Racine, Wis.—Competitive plans for a garbage incinerator will be received Sept. 6 for a plant of sufficient capacity to reduce 25 tons of garbage in 24 hours. Leslie M. Fowler, cy. clk.

East Liverpool, O.—The contract for constructing the garbage crematory was awarded to the Decarie Incinerator Co., of West Minneapolis, for $24,000. Bids are asked until Sept. 3 for constructing a building for the plant. Alex McBane, dir. pub. service.

PARKS.

Palestine, Tex.—An ordinance has been passed to call for a bond issue election for the purpose of two park sites.

Minneapolis, Minn.—The residents in the northeast have petitioned park board to extend the park boulevard.

FIRE APPARATUS.

Toledo, O.—The purchase of an auto fire engine is contemplated.

San Diego, Cal.—Voted to issue $94,000 bonds for a fire alarm system.

Memphis, Tenn.—This city may purchase 2 auto fire engines during the next year. Mayor Crump.

Municipal Engineering

VOLUME XXXIX OCTOBER, NINETEEN HUNDRED TEN NUMBER FOUR

Modern City Planning

By F. Brinkmann, Berlin, Germany

IN EVERY cultured country there is a remarkable interest in the art of city building, a movement which was started in Germany and where it is still stronger than elsewhere. It was therefore not surprising that in 1903 when the first exhibition of city building was held Dresden was chosen as its location, and a second one was held this summer in the German capital. In future years it is expected that other nations will follow this commendable practice. For centuries German cities have been powerful and influential in the commonwealth. Especially when with the foundation of the empire after the Franco-Prussian war, industry and trade developed in an unprecedented manner and people flocked in large numbers to the cities, which grew with surprising rapidity. And unlike France and Great Britain, where Paris and London are much more the capitals and centers of business, art, science, politics, etc., this growth of prosperity and of the population is noticeable throughout the empire and not alone in the industrial districts. We find very large communities in the North and South, in the West and East, some of them having risen to a population of about half a million. Hamburg, Munich, Dresden, Leipzig and Breslau can be compared only with the largest American cities. The rush from the open country was often so great and sudden that new problems were presented to municipalities. Now a particular science has developed during the last 12 years, that is the art of municipal architecture, which is now taught in all technical colleges.

The difficult problem is how we can accommodate the sudden increase in population within the old city limits and how land can be provided and utilized in a systematic and practical manner. Efforts were made to find such new territory but to preserve the old appearance and characteristic of the various towns. Building plans must not be designed according to geometrical rules, but in accordance with the exigencies of traffic and artistic considerations. In the two exhibitions a large number of models, plans and maps were placed on view demonstrating how the cities strive to combine old systems with new ones and to deal with the artistic, technical, social, sanitary and economical side of city building, and with the problem of transportation.

The building up of our communities chiefly on the Continent in Europe is the result of a conception that a ring encircles a town. The development follows a scheme which we may call the concentric plan. In other words a town grows by placing around the borders new rings or belts. This method has been our model for centuries and has found a firm place in our minds. The ring of the fortress, the walls and ditches, the tax belt where the citizens coming from the country had to pay an inland tax, the circular street and railway, they all have put a stamp upon the way of enlarging a city.

This has a harmful effect upon the economical political and traffic development of a community. Its place must be taken by a radial system, we must have rays instead of rings. This applies especially to the free spots still to be built up. These are the grave problems for any big city and Germany took the lead in realizing such projects by providing for a competition, called the "Wettbewerb fuer Gross Berlin." The foremost artists, city engineers, architects and social reformers have done their best to produce maps, sketches and models for a future Berlin. All these were placed on exhibition and were the center of attraction at the Berlin show. However, we are wrong if we think that these projects concern only the people

of Berlin and German citizens alone, for the lessons taken from that prize contest are very valuable for every large community abroad. We were therefore not surprised that numerous requests came from other German and foreign towns who wanted the exhibits loaned for a show of their own. They had to be refused except three, Dusseldorf, Antwerpen and London.

As we have seen before, a principal factor is the division of a large city into wedgelike portions, the main thoroughfares being straight, long and wide, emanating from the center as rays. These all shall have one or more kinds of railways. In nearly every town we observe that the largest returns come from such radial lines and that circular railways are operated with little or no profit. From the standpoint of a traffic expert as well as with respect to monumental structures, the entire city must form a unit with distinctive features in the case of Berlin, the capital.

All towns of the old world show an abundance of curved streets, which are a great hindrance to rapid transit. But even in the recently built outer districts or suburbs we constantly meet curved streets, for the reason that they produce a wonderful picturesque effect. Germany is especially rich with such quaint old crooked roads, the delight of the German citizen and of the cultured foreigner who comes every year to view our old historic spots. It is now the question how can we maintain the picturesque artistic character of the streets and yet comply with the requirements of sanitation and transportation. The practical Yankee, having no sense for beauty and art but rather for money, would say: "Pull down old sections and build the roads straight." This is indeed the simplest way, but the effect would be an ugly town, of which America has more than enough. The modern methods are best executed in Germany and I found excellent examples in the above expositions. The system of curved streets is now being replaced by that of straight thoroughfares, but to avoid a monotonous appearance, so common in the residential sections of London and American cities, the long row of houses must be interrupted by monumental buildings, statues, artistic lamp-posts, small parks and recreation grounds, and different treatment of the street crossings. Thus in viewing along such a modern road our eye does not get tired, for the scene changes constantly.

Another notable lesson can be learned from the German city builder in the matter of the width of thoroughfares. In Great Britain and most other countries they purchase ground just so much as at present is needed for traffic in the particular section. When the latter develops after 5 or 10 years they are forced to widen a road and purchase ground which has risen enormously in value. Besides, numerous buildings have to be pulled down to make room for the sideway, involving enormous costs. In Germany the town administration buys property for a street of such a large width as would be required after 20 to 50 years. Consequently when these districts are built up in the course of years and traffic has developed, the street is wide enough for its accommodation. People would say it is a waste to purchase superfluous ground in advance, but this is not the case, for that portion at present not used for a street or sidewalk is rented to the house owner to be used as front gardens. They are compelled to do this by law or they do not receive the concession to build their houses. Thus in most new sections of the German towns we see long alleys with pretty front gardens. When necessity arises all these or only a strip of them are removed and used for the new sidewalk, the old one having been turned into the widened street.

Much attention is given to a belt of forests and meadows for excursions, picnics, etc. A notable example is the Austrian capital with its wonderful natural surroundings, as we had a chance to see by maps, drawings and an immense model in the Berlin exhibition. Yet in Germany the Vienna example will not be entirely adopted, as those forests and parks make a perfectly closed geometrical ring, forming a drawback to transportation and to the extension of the city. We intend to have these green areas located at intervals around the community; intersecting the latter like a wedge in order to facilitate traffic and general development of the city. Berlin owns considerable areas of forests and large playing fields close to the city borders. The love of the German citizens for nature, especially for the forest, is well known, and in nearly every province exist so-called forest-protection leagues with thousands of members, who

BUILDING MUSEUM, BERLIN, GERMANY.
Exhibits of City Plans, Buildings and Municipal Matters.

arouse public interest to preserve their very precious forests. Much valuable work has been achieved by them and hundreds of acres of forest area has been saved. Railways and fine smooth country roads are laid through these surroundings, insuring good transportation and pleasant drives. Inside the towns the numerous parks and promenades receive full attention and compare well with the noted American parks, which in the Berlin show occupied a whole room. We were impressed by the pictures and sketches showing the play grounds, swimming and rowing ponds, reading rooms, drive ways and wading pools of the American system. The latter were adopted by the Berlin county council immediately after the close of the exhibition. We also had a chance to see the foremost universities of the United States with their beautiful surroundings, and we envied them for the immense space available to allow such a system of laying out the college buildings and campus park. In the old world space is scarce and the houses have to be built narrower and closer together with small areas for parks.

In the same way as the park system is most up-to-date in America, so the garden cities of Great Britain, which occupied a room in the last exposition, are most nearly ideal. Port Sunlight, Letchworth and others are too well known to need description. In the German empire the garden city idea has made its appearance in the last five years and Berlin can boast of having some wonderful suburbs of this kind. Dresden and the famous workmen colonies of the cannon king, Krupp in Essen, are other notable examples.

In the matter of transportation in all cultured countries very remarkable improvements have been made hand in hand with the development of traffic. Here Germany is again far in advance of any nation in the matter of safety and protection for passengers and employees. The signal system, guarding of road crossings, sanitary conditions of compartments, stations, workshops, old age and accident insurance are yet unsurpassed and stand most in contrast with the United States, where railways are operated only for money. Berlin owns a special railway museum, recently opened, where every one interested will find excellent material from which a lesson can be taken. From the various diagrams and statistics placed on view we noticed that underground local lines are only yielding a profit within the city limits. In the suburbs only street cars, elevated or level railways can be profitably worked.

Street Paving in New Orleans

By Martin Behrman, Mayor

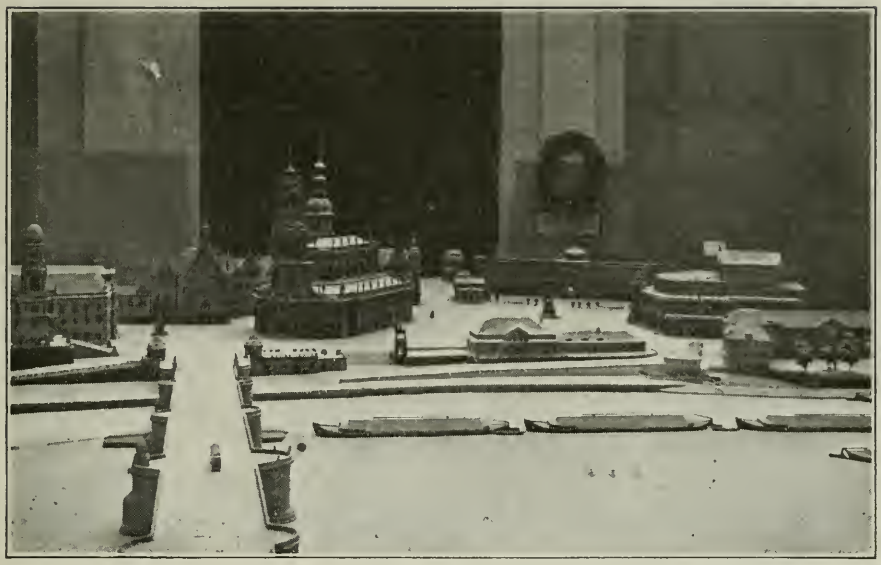
IN a paper by Martin Behrman, mayor of New Orleans, read before the League of American Municipalities, the street paving problem of that city is dealt with in a clear, concise manner. In the first of his paper Mr. Behrman comments on the slowness of New Orleans in the matter of paving her streets, and explains this tardiness by giving an account of the unusual conditions in levee construction, sewerage and water works problems, etc., that had to be met and overcome before the matter of street paving could be considered. A short abstract of the latter part of the paper is given herewith.

All the wide streets are subdivided so as to provide a neutral ground or parking strip at the center, a roadway on each side of same and a sidewalk on each side of the street. These parking strips vary from 20 to 100 feet in width, depending on the width of the street; the roadways, depending on the importance of the thoroughfare, from 18 to 35 feet in width; and the sidewalks from 10 to 20 feet in width.

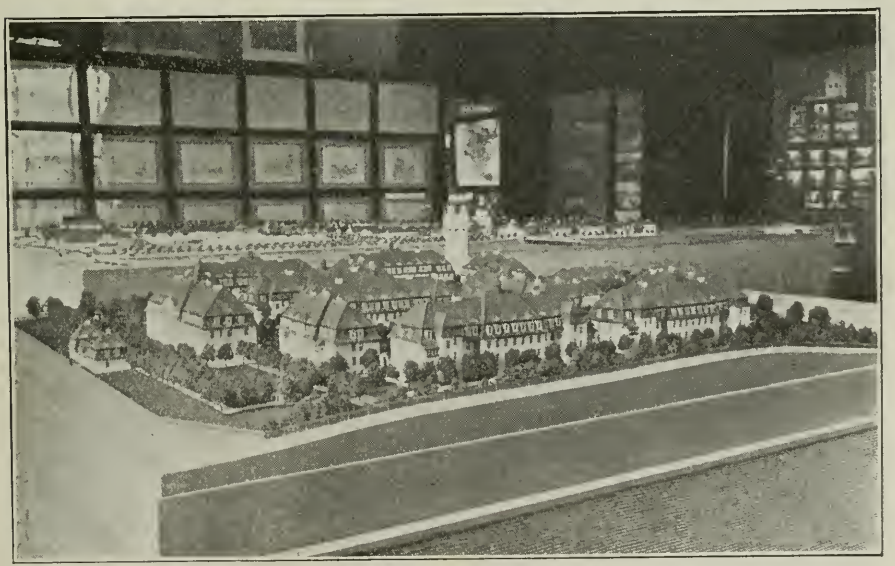
The paving of a street or construction of a sidewalk is brought about either by a petition of 52 per cent. or more of property frontage or by forced action of the City Council with a two-thirds vote. In either case the property owners have the right to designate the paving material.

In the case of original paving, whether the paving be petitioned for or ordered by the Council, the city bears the cost of paving street intersections and one-quarter of the roadway between street intersections.

In the case of repaving on petition of property owners, they bear the en-



MODEL OF THEATER PLACE ALONG ELBE RIVER, DRESDEN, GERMANY.



MODEL OF HOSPITAL BUCH, OWNED BY THE MUNICIPALITY OF BERLIN, GERMANY.

tire cost of the paving between the street intersections; but, if the repaving be ordered by the City Council, the city bears one-quarter of the cost of the paving between street intersections. In all cases the city bears the entire cost of paving or repaving street intersections and the entire cost of installing sub-surface drains.

The street railroad companies are required by their franchises to pay the cost of paving between their rails and for one foot outside of each rail. They are additionally obligated to maintain that part of the pavement throughout the term of the franchise.

In paying for the pavement the city engineer and street commissioner issue in favor of the contractor a bill against each property owner for his portion of the cost of paving, and the contractor must collect these bills. When recorded in the mortgage office these bills constitute a first lien on the property, superior to any mortgage or even vendor's lien.

The original pavements in the commercial district, laid in the early history of the city, were formed of square granite blocks, about 18 inches by 12 inches by 12 inches, laid on a 2-inch-thick cushion course of cinders, placed directly on the ground surface. This material was imported from European ports or from Maine. A few streets were at this time surfaced with 3-inch by 12-inch wood boards laid on ground sills. Some of the residential streets and the suburban roads were paved with oyster and lake shells, the latter being a species of clam. The shells were laid on 1-inch by 12-inch pecky-cypress boards to afford a good bearing because of the more or less soft and yielding character of the soil. Shell pavements usually consisted of a base course of 6 inches in thickness of oyster shells and surfaced with 6 inches in thickness of the lake shells. These made a very superior pavement, but so perishable as to require constant repair to keep them in good condition.

The first modern pavement—that is, asphalt—was laid on St. Charles avenue, a residential thoroughfare, in 1883, under a twenty-year maintenance, and cost $3.50 per square yard. A considerable portion of the asphalt wearing surface has worn out and has been renewed, but a portion of the original pavement is yet in service and in fairly good condition.

Shortly following the paving of St. Charles avenue a few other streets were paved with asphalt. About this time an active promoter introduced a form of concreting clay-gravel pavement, which was so much cheaper than asphalt and afforded so much satisfaction that it became popular, and a large number of streets were paved with it. But, like the shell roadways, the gravel pavements were perishable, and after a period of service worked into bad condition and became as unpopular as they had previously been popular.

Following this era of gravel paving, and for a few years thereafter, paving matters were almost at a standstill. The people did not seem to sufficiently realize the importance of modern pavement to be willing to pay for it. As a consequence the few streets that were paved from time to time were by forced action of the City Council, and oftentimes when the Council exercised its legal privilege in this direction there was very violent protest.

This condition of affairs no longer exists, nor has it existed for the past six years or more. The demand for pavement seems to be increasing. Although the Council meets twice each month, there is not a meeting but two or more paving petitions are filed. There are now about one hundred of these petitions on file, working their way through the necessary legal formalities of publication, etc.

During the past ten years 82 miles of streets have been paved or repaved at a cost of $6,384,138.27, of which the city paid for sub-surface drains and its portion of the paving $4,167,469.50. The net increase during the past ten years in street paving has been 67 miles, as the 15 miles forming the remaining portion of the 82 miles was repaving, which consisted in substituting modern for inferior pavement.

Contracts have just been made for five and one-half miles of street paving, which will cost approximately $544,000, of which the city will pay for sub-surface drains and its portion approximately $347,000.

The following is a list of the kinds and amounts of street pavements of New Orleans today:

Square granite block	28.95	Miles
Small granite block	4.14	"
Cobblestone	33.71	"
Shells	24.94	"
Gravel	36.45	"
Vitrified brick	10.10	"
Asphalt	70.08	"
Plank	38.60	"
Bitulithie	9.75	"
Granitoid	9.23	"
Mineral rubber	2.57	"
Total	268.52	"

There are approximately 525 miles of streets in the improved area of the city. Of these, as just stated, 268.52, just a little more than one-half the total, are paved. The forms of pavement most popular with the people are asphalt, bitulithic, granitoid, and mineral rubber, with small granite block in the commercial sections, where traffic is heavy both as to number of vehicles and tonnage per vehicle. Practically all of the vitrified brick pavements were laid about fifteen years ago. Only one street has been paved with that material during the past ten years.

The great number of asphalt streets and the question of their maintenance led to a discussion of the matter of a municipal repair plant. It was decided, after a consideration of conditions in Detroit and other cities, to install such a plant, with a view to making other improvements as well as repairs.

The city engineer very carefully investigated and studied the matter, and estimated what the repairs would annually cost if made by a municipally owned and operated plant; but before deciding to adopt that method, bids were asked for a contract to keep all the pavements on which the contract of maintenance had expired, or would expire during the contract period, in good order and condition for three years.

Two companies bid for this contract. The bid of the lowest was $114,500 for the first year, $40,000 for the second year and $40,000 for the third year, making a total of $194,500 for the three years. The great difference between the bid for the first year and the succeeding two years was due to the bad condition of the pavements and the very large amount of work necessary to put them in good order to commence with. The city engineer was confident that he could care for the pavements for a much less cost than the amount of the lowest bid, and decided to build a plant.

The city owned half a square of ground at a point constituting an ideal site. This site was situated on the bank of one of the two navigation canals, and possessed railroad-switch-track connections, thereby making the delivery of materials both convenient and economical. The erection of a stationary plant was contracted for, to be inclosed in a brick building, and having a capacity of 1,200 square yards of wearing surface per day of ten hours' work. The cost of this plant was $16,862.50.

The city engineer purchased the necessary materials and employed the required labor and erected all the buildings incidental to the plant. The plant, including rolling stock, live stock and all tools and equipment, both at the plant and for street work, originally cost $66,008.82, since which $11,193.66 has been expended for additions and improvements, so that to-day the plant represents a total expenditure of $77,202.48, exclusive of the site. The plant is equipped with a very complete laboratory for testing all kinds of building materials, including a rattler for testing the abrasive strength of brick and stone, and with an electric stone crusher.

The street paving contracts provide that all old materials in the way of curbstones, paving stones and iron not required in the execution of the contract shall be delivered by the contractor to the municipal repair plant. These old materials, which amount to thousands of dollars in value each year, formerly went to the contractor, who rarely made fair allowance for their value in his bid; but the plant has had the advantage of having them without cost for use in the work it has done.

About seven months were consumed in constructing and equipping the plant. It was put in operation on the 1st of September, 1906, at which time there were 352,302 square yards of asphalt pavement to maintain. To-day about 641,000 square yards are maintained.

Based on the total square yards to be taken care of, the average cost per square yard for materials and labor for the first year's repairs was 11.44 cents; for the second year, 7.8 cents, and for the third year, 5.74 cents. Each year the cost for labor and materials was less than the bids stated. For the three years the cost of labor and materials, including all fixed charges and cost of repairs and renewals, was $93,165.62, which was $101,334.38 less than the $194,500 which would have been paid for the same work under the bid. The plant has constructed new asphalt pavement in a number of street intersections, in several alleys and in front of several markets and other public buildings, where the city bore the entire cost of the work. All asphalt pavements are worked over each month, and are, therefore, at all times, in good condition; and where pavements show signs of early disintegration, the repairs are made before the break occurs.

The efficient manner in which New

Orleans cares for and maintains her paved streets, and the progress made in the last few years, indicate that much may be expected in that line before 1915, when New Orleans hopes to hold the Panama World's Fair.

Problems of Milwaukee's New Administration

THE statement was made at the convention of the League of American Municipalities, held in St. Paul in August, 1910, that Milwaukee, under her socialistic administration, was receiving a great deal of credit for doing something entirely new, when in reality she was going over old ground and not showing much progress in that. Such a statement hardly seems justifiable in the light of what has been accomplished.

The conditions in Milwaukee when the socialists set to work, were, to say the least, discouraging. The system of public accounting had been so handled that money was taken from current appropriations to take care of back deficit. The city had been spending more than its revenue, and then covering the deficiency by using the proceeds of bonds issued for other purposes. As a consequence there was impending an annual deficit of $200,000. Moreover, the new administration could borrow very little money, because of the fact that the city's debt was already close to the legal limit, and the tax rate was fixed by law so as to be unchangeable. These were the conditions which have perhaps made progress slow in Milwaukee.

It is true that the ideas set forth in the platform upon which Mayor Seidel was elected, were not radically different. They are briefly:

Home rule.

Public ownership of public utilities.

A municipal terminal and municipal wharves.

Equal and just taxation.

Public slaughterhouses, public markets, public cold storage.

Public improvements by the city; no contract system.

Municipal quarry, wood and coal yards, work for the unemployed.

Extension of the city limits, sanitary homes, factories and schools, play grounds for children.

Dispensaries, four hospitals.

Public comfort stations.

Sewage and garbage disposal.

Small parks, shade trees, the abolition of slum neighborhoods, a municipal lodging house to abate the tramp nuisance.

School extensions, free text books, ters.

Fair treatment for all city employees, no dismissals without public trial.

In the method of obtaining these free concerts in the parks, social cenhings, and in the ideas underlying them, will be found the new idea the socialists hold.

First of all they set about doing away with the spoils system of office holding. Those offices which had been mere sinecures were abolished. Offices were combined where the duties were similar and light, and departments were so rearranged that a combination of duties might be more conveniently made. The mayor's body guard was sent out to patrol duty, and it was made plainly evident that the city demanded efficiency in all departments.

Those things which have been accomplished in the five months of the present administration, may be briefly summarized as follows:

Health department has proven typhoid epidemic due to bad water, a condition previously denied and neglected. Prompt measures for permanent purification taken.

Tentative understanding reached to issue no more bonds for city maintenance, or running expenses, but for permanent improvements and land only.

Plans are under way and a tract selected for the site of first municipally owned workingmen's homes.

Public works department reorganized on efficiency basis. Experts placed in charge of the various departments of the board of public works.

Twenty-four hours off every fifteen days granted to policemen, over protests of the chief.

Reorganization of accounting system in comptroller's office under way.

Shiftless and incompetent work in street paving stopped by the mayor after personal inspection.

New park selected.

Decision by park board to investigate foodstuffs and drinks sold in parks, to shut out all impure products.

City treasurer redeemed bonds before maturity, saving interest to city.

City attorney brought old suits into court, winning for city a number involving damages. Halted practice of "agreements" and "friendly suits."

City attorney has begun action to recover $72,000 from street car company, which has been accumulating in unpaid license fees during ten years. Action begun for better car service, several ordinances now pending; also for cross-town car lines, a vital need, ordinances granting franchises to force company to run cars pending in council.

City attorney won case against St. Paul road before railroad commission for track depression, commissioner giving decision from bench without argument.

Council appropriated money to install unit system of cost keeping, which will put Milwaukee in lead of all American cities in this respect. City will bid on all public work, doing away with contracts.

With reference to the changes in the comptroller's office, it may be noted that under the old system no regular reports were called for. Obsolete filing systems were in use and no check nor inventory was to be had of office fixtures, supplies, etc., in any department. A regular system of reports is now enforced and an entirely new system of departmental accounting is being installed. All complaints are received and attended to either by form letter, personal letter, or personal inspection as the case may demand. The members of the council and the administration are closely in touch with every department and a regular system of reports keeps them informed on all current matters. The sum of $5,000 has been appropriated to install a cost keeping system under expert supervision. This system is intended to cover all classes of public work and has for its object the abolition of excessive profits, and poor material; for it is intended that the materials shall be tested up to the required standard as shown by the known costs of material asked for. The ultimate aim is, of course, public improvement under the day labor system.

The statement that Milwaukee has made little progress in carrying out her plans may perhaps be granted; but in view of the difficulties encountered and the change from the old established customs, it must be conceded that much has been done. The five months under a socialist mayor have at any rate served to lay the foundation for a future advancement that may mean a great deal to other municipalities as well as to Milwaukee.

Wooden Block Pavement Tests in Minneapolis, Minn.

By D. M. Avey, Indianapolis, Ind.

THE great number of failures recorded against wood block pavements previous to 1906 led to a discussion concerning the merits of such paving and a desire for a decisive test of its real value. In accordance with this desire a cooperative comparative test was undertaken by the Forest Service of the U. S. Department of Agriculture, the city of Minneapolis, the Kettle River Quarries Co. of Minneapolis, and the Republic Creosoting Co. of Indianapolis. The pavement was built in July, 1906.

By the terms of the agreement between the above mentioned parties, the division of responsibility was made as follows: The Forest Service furnished about fifteen thousand (15,000) feet of the requisite sizes of white birch, western larch, jack pine, red fir and hemlock lumber; the Kettle River Quarries Co. manufactured, furnished the oil, and treated the first three varieties, and the Republic Creosoting Co. did the same with the last two and also the southern pine, Norway pine and tamarack, on regular contract. The city of Minneapolis prepared the foundation, put in the concrete base, laid the blocks and completed the details of the paving, furnished records as to cost, sprinkling, cleaning, etc., and takes traffic records twice a month.

The method of laying the blocks is shown by the accompanying diagram, the numbers referring to the locations and kinds of blocks as described in the statement given in the following description:

1. Norway pine, 6, 8 and 10-inch blocks, 16 pounds of oil per cubic foot.
2. Tamarac, 6 and 8-inch blocks, 16.2 pounds of oil per cubic foot.
3. White birch, 6 and 8-inch blocks, 22.1 pounds of oil.
4. White birch, 4 and 6-inch blocks, 22.1 pounds of oil.

Classes 3 and 4 are laid each on one-half the width of the street.

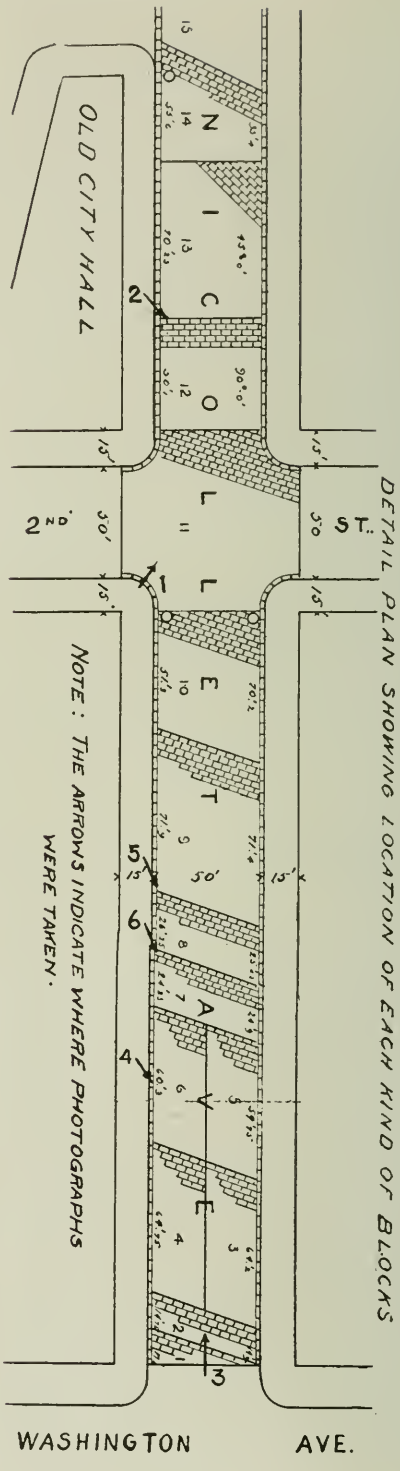
5. Western larch, 4-inch blocks 20.4 pounds of oil.
6. Western larch, 5 and 8-inch blocks, 20.4 pounds of oil.

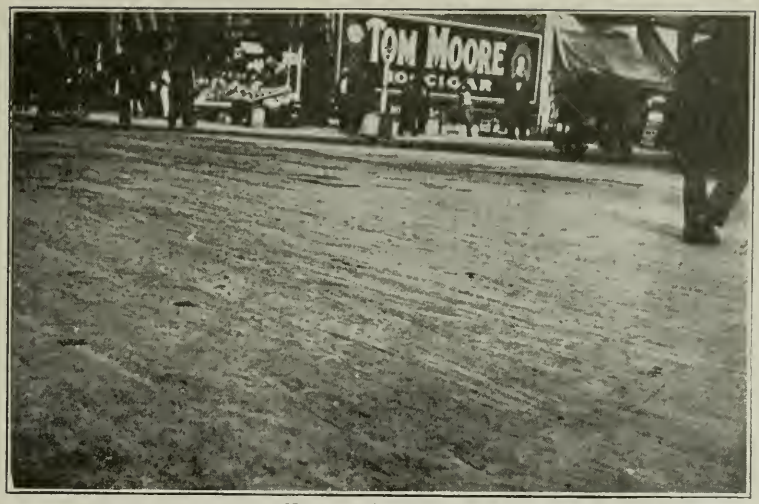
Classes 5 and 6 are laid each one-half the width of the street.

7. Red fir, 6 and 8-inch blocks of fine grained wood, treated with 15.8 pounds of oil per cubic foot.
8. Red fir, 4, 6, 8 and 10-inch blocks of coarse grained wood, 15.8 pounds of oil.
9. Southern pine, 6 and 8-inch blocks, 18.5 pounds of oil.
10. Hemlock, 4, 6 and 8-inch blocks, 15.5 pounds of oil.
11. Norway pine, 6, 8 and 10-inch blocks, 16 pounds of oil, this section being the intersection of Nicollet avenue and Second street.
12. Norway pine, 6, 8 and 10-inch blocks, 16 pounds of oil, laid with courses perpendicular to the curb.
13. Norway pine, 6, 8 and 10-inch blocks, 16 pounds of oil, laid with courses at angle of 45 degrees with curb.
14. Tamarac, 6 and 8-inch blocks, 16.2 pounds of oil.
15. Norway pine, 6, 8 and 10-inch blocks, 16 pounds of oil.

A further description of the starting of the experiment will be found in MUNICIPAL ENGINEERING, vol. xxxiv, page 14, to which reference may be made for details of construction. The most careful workmanship and the best of materials were employed.

An inspection of the pavement on August 21, 1910, shows that some comparison may be made at this time, though more definite results may be attained by a continuance of the test. In making the comparison it must be noted that the section to the right of the diagram was subjected to much the heaviest traffic, for, in addition to the heavy haul from First street to Washington avenue, due to drayage from the railroad, there are three stone companies located so that all of their loaded four-horse wagons delivering material must follow along Nicollet avenue from First street to Washington avenue. A comparison will be attempted in the following or-





1. Norway Pine, Section 11.

2. Norway Pine, Section 12.

3. Tamarack and White Birch, Sections 2, 3 and 4.

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der: The kind of wood; the size of blocks; the grain of the wood, fine or coarse; and the manner of laying. It will be noted that all the blocks were laid with the grain vertical, and the joints were filled with pitch. The roadway is 50 feet wide and has a crown of 8 inches.

With regard to the best kind of wood for wood block pavement, Norway pine seems to show the most uniform wear. In the diagram, sections 1, 11, 12 and 13 are of Norway pine and they are without doubt in the best state of preservation. Section 11 in particular is in excellent condition, even though exposed to the double traffic along Nicollet avenue, and also along Second street; though that along Second street is not excessive. Two photographs show the excellent condition of the Norway pine at the present time. No. 1 showing section 11 and No. 2 showing section 12. In point of value for paving the other woods are in the following order, judged by their present condition:

Southern pine and tamarack show very little difference and perhaps might be rated nearly on a par, as neither kind of wood shows evidence of much pitting. Photograph No. 3 shows the tamarack of section 2, being that portion nearest the camera anl up to where the first hollows are shown.

Hemlock shows very little inferiority to the two last mentioned woods, though a comparison made between section 10 (hemlock) and section 9 (southern pine) shows points in favor of the southern pine. In this case as the two sections adjoin each other, the conditions of wear may be assumed to be identical.

The other three woods take fourth, fifth and sixth places in point of preservation and uniform wear, as follows: White birch, western larch and red fir. The last named wood, red fir, is in a very bad state at the present time; hollows to the depth of 3 or 4 inches and of 2 or more square feet are noted, while in at least one instance it has apparently been necessary to patch the surface with new blocks. Photograph No. 4 shows the western larch. Nos. 5 and 6 indicate the condition of the surface of the red fir. Photograph No. 3 shows the white birch, sections 3 and 4, in the background, beginning with the hollows showing in the surface.

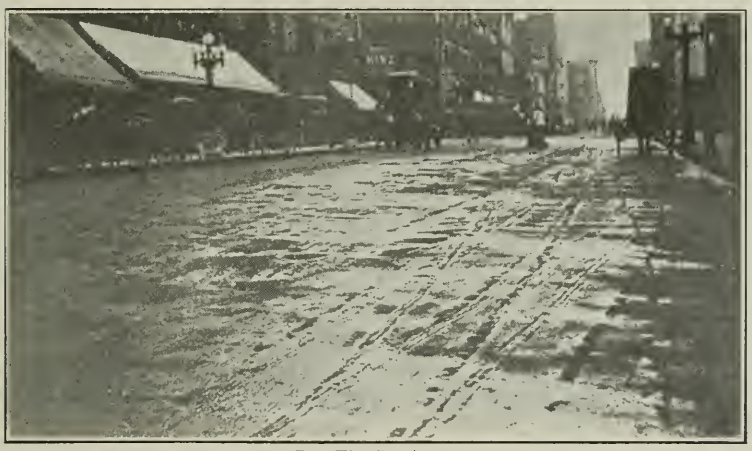
As for the question of the size of blocks best adapted to wood block paving, a mere inspection of the test pavement at this time does not warrant a decision. Section 3, of 6- and 8-inch white birch blocks is in better condition so far as uniformity of wear is concerned than is section 4, of 4- and 6-inch white birch blocks. They are shown in photograph No. 3 in the background, section 3 being on the right half of the street. But on the other hand, section 5, of 4-inch western larch, is much better than section 6, of 6 and 8-inch blocks. Section 5 is on the farther side of the street and section 6 on the nearer side, in photograph No. 4. From this it may be assumed that the difference of wear is due to the heavier traffic over sections 4 and 6 rather than to any influence of the size of block.

Sections 7 and 8 illustrate the difference in value between fine grained and coarse grained woods in the case of red fir. In this case the two sections adjoin so that the traffic conditions must necessarily have been identical, but section 8 (shown in photograph No. 5) is in much better condition than section 7 (shown in photograph No. 6). The fine grained fir in this case shows deeper and larger hollows than the coarse grained wood of the same variety, and it was noted that it has apparently been necessary to patch the former.

With regard to the manner of laying, that is, the angle at which the courses are laid, it would seem that more time is necessary to determine fully the best procedure. In the case of the Norway pine, section 11, which was laid with the courses at an angle of 67 degrees and 30 minutes with the curb, it seemed to be in better condition than section 12, which was identical in every particular, except in the angle of courses, which in this case was 90 degrees. But on the other angle of courses, which in this case was 90 degrees. But on the other hand section 13, laid at 45 degrees was not as good as section 12 and hardly to be compared at all with section 11. A comparison of photographs No. 1 (section 11) and No. 2 (section 12) will illustrate the superiority of section 11. If the final results of the test are what the present condition would indicate, it would seem that an angle approximating 67 degrees and 30 minutes was the happy medium to be sought.

The purpose of this article is not to set forth the results as being demonstrated by this test thus far, but rather to offer a report of its progress, and it is hoped, an indication

4. Western Larch, Sections 5 and 6.



5. Red Fir, Section 8.

6. Red Fir, Section 7.

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of its value. The final results, when announced through the medium of the Forestry Department are certain to be of value in determining the fate and future of these kinds of wood as paving materials.

Work Preliminary to Road Construction and Street Pavement Maintenance*

By George C. Warren, Boston, Mass.

I PROPOSE to show that the success or failure of a pavement is fully as likely to depend upon causes beyond the contractor's control, both preliminary to the construction of the pavement and subsequent to its completion, as upon perfect or faulty workmanship or materials; although, when a pavement fails to sustain traffic, the public universally, and officials generally, attribute the result to a combination of inefficiency and poor material, for which the contractor is held responsible.

At the outset I believe we shall agree that water is the great enemy of pavements, and the most common cause of their undoing, even when blocks of sandstone or other comparatively soft stone are used. The only material that is not seriously injured by the destructive influence of excessive water is granite and even that is injuriously affected.

The sources of deterioration from water may be summarized as follows:

(a) Improper sub-drainage.
(b) Excessive sprinkling or flushing.
(c) Lack of efficient cleaning.
(d) Sub-drainage, due to the absence of pavements, or to their improper construction, between and around railroad tracks.
(e) Too flat crown or grade to provide proper surface drainage.

All of these features are absolutely beyond the control of the contractor, yet they provide most fruitful sources of dispute between him and municipalities as to the responsibility for defects which develop subsequent to the expiration as well as during the maintenance periods of paving contracts.

A discussion of each of these features will be useful.

Sub-Drainage. Perhaps there is no part of street pavement construction which is given so little intelligent consideration by engineers, or in which local custom is so blindly followed from decade to decade, as this matter of sub-drainage. And yet practically every writer on street pavement construction from John MacAdam to the present day has referred to sub-drainage as the first essential to successful road or pavement construction. We find cities where the prevailing sub-soil is clay, that affords inadequate natural drainage, providing no artificial drainage for their pavements. We find other cities where the sub-soil is either sand or gravel, that affords the best possible natural drainage, providing for their pavements elaborate systems of sub-drainage that are of course wholly unnecessary. Again, we find cities adopting systems of sub-drainage in use in other cities where the sub-soil, and, consequently, the artificial drainage requirements, are radically different.

Several years ago I learned of a most glaring example of this copying process, which illustrated perfectly the lack of application of ordinary engineering, not to say "horse" sense in pavement drainage. The municipal authorities of a lake city built on sand dunes, and having few manufacturing industries or railroads, evidently feared that the local engineers were not competent to prepare the plans and specifications for expensive paving work, so they engaged for the purpose a consulting engineer from Chicago. He practically copied the standard plans and specifications of the City of Chicago. It is well known that the prevailing soil in Chicago is clay, and that the railroads and factories of the city provide large quantities of cinders, which serve the purpose of an excellent cheap filling for sub-drainage purposes. In copying the Chicago specifications, in general, the engineer included the drainage specifications, which called for soft tile below the curb, and filling of cinders around the tile and to the

*A paper before the American Society of Engineering Contractors.

bottom of the curb. The result was a very elaborate and expensive artificial drain system, wholly unadapted to the conditions, that had to be met. The specification provided for cinders, which had to be carried over two hundred miles by rail to be used in the place of the sand upon which the city stood, and which at no expense, would supply the best possible natural drainage to be procured. Evidently the engineer in this case gave absolutely no consideration to local conditions, but blindly copied and adapted what had been found good for Chicago.

As a general rule, however, the fault with drainage is due to the fact that no artificial sub-drainage is proveded, when the natural drainage conditions are wholly inadequate. In such cases, the under side of the pavement is always damp, and the inevitable result is deterioration, and a tendency of the pavement to settle from its normal shape and grade.

In a certain city of Central New York, which I have had especial opportunity of studying during the past twenty-four years, the pavements have proved to be better than those in any other city of the United States or Canada which I have visited, although the sub-soil is generally clay, the poorest medium for natural drainage. Apart from careful construction and selection of material used in the pavement, which have not been greater than the care shown in similar work in other cities where the results have been far less satisfactory, I attribute the unusual excellence of these pavements chiefly to the elimination of water, both from the under and upper surfaces. This has been accomplished:

First. By an efficient system of sub-drainage; and

Second. By thorough dry cleaning and entire absence of wetting down the dirt by excessive street sprinkling and flushing.

The system of sub-drainage in this case, which was adopted in the year 1886 and has been strictly adhered to since, is as follows:

(1) A trench 1 foot wide is excavated under the curb to a depth of 3 feet below the top, or 18 inches below the bottom of the curb.

(2) In the bottom of the trench is placed a narrow culled hemlock board, for which other cheap lumber may be substituted, and the pavement side of the trench is boarded up with the same material, up to the bottom of the curb, to prevent the earth under the pavement, as it dries, from falling into the drain.

(3) On the board in the bottom of the trench is placed a line of three inch half round porous tile open at the bottom and with open joints.

(4) Over the tile the trench is filled to within two inches of the bottom of the curb with hand placed field or cobble stone, over which is spread a thin course of finely crushed stone, slate shale, or slag, fine enough to fill the chinks in the field stone at the surface but coarse enough not to run into and fill the spaces between the pieces of field stone.

(5) Over this is spread about an inch of loam or clay (not gravel or sand), which, when dry will hold together and not sift into the drain.

(6) Over this curb is set in the usual way. If the curb is of stone, it is bedded in either gravel or concrete; and if the curb or gutter is of Wainwright or other Portland cement, it is laid directly over the drain. Of course the drains are connected with catch basins.

This method of construction is the best, most efficient, and most economical system of sub-drainage I have ever known. No cross drains have been necessary, although the natural drainage conditions are very poor.

Systems of surface drainage of which I thoroughly disapprove, either because of inefficiency or unnecessary expense are those that include:

(a) Too shallow drains at the curb: and

(b) Trenches filled with crushed stone in the center of the road with similar cross drains at intervals.

The cross drains tend to attract water from outside the roadway and carry it under and to the center of the pavement, where it percolates into the otherwise dry sub-soil. This is not only an unnecessarily expensive system of sub-drainage, but one that is really less efficient than no drainage.

It may be set down as a fact that with any of the modern, nearly waterproof forms of pavement now in vogue, unless there are actual springs under the roadway (an extraordinary condition that requires extraordinary treatment), the sub-soil under the pavement will be practically bone-dry if no water is allowed to percolate from back of the curb. To prevent this a drain having a depth of three feet below the curb is all that is necessary. As indicated above, if the sub-soil is gravel or sand, providing natural drainage, through which water percolates, no artificial drainage is necessary.

The most frequent causes of failure

in pavement construction, all of them being entirely under the control of city officials, and just as entirely out of the control of the contractor, are as follows:

First. Inefficient or no drainage. This we have considered above in considerable detail.

Second. Improper back-filling of trenches.

Third. Insufficient crown and gutter grade to carry off water and prevent pools standing near the center and in the gutters of the roadway.*

Fourth. Lack of cleanliness.

Fifth. Excessive flushing or sprinkling of streets.

Sixth. Inadequate pavements, or none at all, between and along railroad tracks.

These faults are of such importance as to warrant careful consideration. They directly affect pavement maintenance and guarantee from both practical and legal points of view and are not second in importance or cause of trouble to even poor workmanship and materials employed in the construction of the pavement.

The two seriously objectionable practices, lack of cleanliness and excessive watering of street pavement surfaces, generally go together because;

First. If the street surface is not clean, wetting is necessary to allay the dust, and in this way mud is formed; and

Second. If the dust is converted into mud, the mud can be removed from the surface of the road only by the use of an excessive quantity of water, under such high pressure as to damage the pavement.

Recognizing that water is the enemy of all pavement surfaces, the effort of those engaged in the improvement of road surfacing material of every kind is directed toward reducing the porosity of the roadway surfaces, and otherwise protecting them from the ravages of excessive wetting.

On the other hand, the efforts of some street cleaning interests are directed toward keeping the streets wet by various forms of sprinkling and flushing machines, without properly cleaning the surface of the pavements. Still other interests engaged in street cleaning advocate dry cleaning and are developing methods to accomplish their purpose. Their objects are feasible, but, pending the advent of machines that will efficiently and economically do the work, all municipalities should take a middle ground, and follow one of the following courses:

(a) Thoroughly wash the pavements nightly, without pressure, using either a washing machine or fire hose, and immediately follow the washing with hand squeegees to remove all excess of water from the gutters and slight depressions.

(b) Sweep nightly with machines, lightly sprinkling the pavement in advance of the sweeper, and using enough water to lay the dust but not enough to convert it into mud, exactly as a dirty floor is cleaned by light sprinkling and hand sweeping.

No one would think of wetting a floor to such an extent as to convert the dust into mud, and then expect to remove the mud by sweeping. Yet the equivalent of this is done in most cities where the attempt is made to clean the pavements by rotary brooms immediately following a thorough wetting by sprinkling wagons. After such an operation is it any wonder that, covered with water and earth or sand (a mixture that will sharpen and wear away the hardest steel), pavement surfaces are literally butchered by the grinding they receive from the wheels of the traffic?

Either of these methods specified, if carefully and properly applied, will provide a well-cleaned pavement surface which will require no sprinkling through the day, if hand cleaned by patrol system by day. The adoption of such a system will insure a pavement that will always be in the best condition for horses, automobiles, as well as pedestrians on the sidewalks, being free from dust and mud, and capable of sustaining traffic without deterioration.

Track Construction. Railroad beds improperly constructed, or tracks poorly laid, are common sources of injury to pavements, and the damage will extend not for only a few feet from the rails, but sometimes across the entire width of road bed. The same undesirable results are often produced by faulty construction in the pavement itself between and along the rails. If the rails or the ties are not so securely laid as to prevent vibration, the pavement, whatever may be its construction or the material used, will be sure to break and allow water to work its way

*"Back-filling of Trenches" and "Pavement Crowns" have been subjects of papers prepared by Mr. George C. Warren for the convention of the American Society of Municipal Improvements, copies of which may be obtained by addressing Mr. Warren, 59 Temple Place, Boston, Mass. They may also be found in MUNICIPAL ENGINEERING, vol. xxxiv, p. 21, and vol. xxxviii, p. 88.

through and settle beneath the pavement. I have seen, in a number of cities, first class pavements laid outside the track area, from the rail to curb, or from within two feet of the rail to the curb, while between and around the rails there would be absolutely no pavement at all. In such cases from one to three inches of water will accumulate between the tracks during every heavy rainfall or spring thaw, and have no outlet except into and under the pavement; and if the pavement is not more or less destroyed it is only because Nature has provided conditions which permit the water to drain nearly vertically into and through the soil.

Maintenance Guarantees. Turning more specifically to the subject of pavement guarantees and maintenance, I am firmly of the opinion that pavement guarantees extending beyond a term of one year, which is ample to test the integrity of material and construction, are against the best interests of the taxpayers. In support of this view, I offer the following reasons:

First. Guarantees are always of doubtful legality. On assessment work, which is the basis of payment for over 75 per cent of the street pavements laid in the United States and Canada, the courts have frequently, if not generally declared maintenance guarantees to be illegal, because they provide for indirectly assessing abutting taxpayers for the cost of maintenance, which city charters usually say shall be paid for by the city at large.

Second. There is always likely to be more or less dispute between the contractor and the city regarding the contractor's obligations to make certain repairs, especially when the damage done can even remotely be attributed to causes such as these to which we have referred as lying outside the jurisdiction of the contractor, and, similar contentions will arise between the contractor and the city as to the extent of repairs and nicety of condition of maintenance of the pavement which is proper under guarantee. It is not an exaggeration to say that under guarantees, cities generally endeavor to require contractors to make repairs to pavement surfaces that they would not think of making at the expense of the city.

Third. When guarantees for maintenance are required, prudent, conservative contractors always include in their bids the interest on the cash retained, and the cost of the surety company bond premiums required by the city, and a sufficient amount to cover a conservative estimate of maintenance charges. It has been calculated that if surety company bonds for five years maintenance were required on all pavements laid in the United States and Canada, the premium, always added to the contractor's bid, would each year amount to more than a million dollars.

It has been suggested that in lieu of surety company bonds for guarantee the cities retain 5 per cent of the contract price. If this were generally adopted the cash retained by the cities would aggregate approximately $5,000,000.00 annually, and the interest alone on the accumulation of five-year guarantee periods would amount to $1,500,000.00. This bond premium, or interest, contractors must add to their prices when the cost of labor and materials advance. Generally speaking, contractors, regardless of the estimated cost of maintenance, will add to what would otherwise be their contract prices the full amount retained by the city. Few contractors are sufficiently strong financially to have their capital tied up, even when it is drawing interest. Such a system would drive the comparatively small, but reliable, contractors out of business, and leave the field in possession of concerns that are financially strong enough to carry or negotiate for carrying the amount of money retained by the cities.

Fourth. Maintenance guarantees tend to produce lax inspection, or the loss of control of construction by the proper city officials, as the contractor, in case of dispute or disagreement as to the methods of construction, will notify the city officials that if he is not permitted to do the work in the way he thinks best he will not be responsible for the guarantee.

Fifth. Maintenance guarantees encourage the acceptance of proposals from incompetent or inexperienced contractors, and the selection of pavements of doubtful desirability. How often do we hear the statement made in connection with the awarding of street pavement contracts, "The contractor may not be reliable, or the pavement may not be successful, but we have the surety company bond, or the cash retained to back the five-year guarantee."

In twenty-five years' experience in the street paving business I have seen many paving contract guarantees defaulted, but I have never seen a pavement made good through a guarantee bond or a cash retainer, when the pave-

ment or the contractor failed, or when it was against the business interests of the contractor "to make good." There may be such cases, but if there are, they are usually the "exception which proves the rule."

Finally the best interest of the city in the construction of pavements will be conserved, as it is in all other classes of construction, by the adoption of the following policy:

(a) Decide upon the form of construction best suited for each particular case.

(b) Prepare careful plans and specifications for the work, and give the construction the closest and best expert inspection and supervision.

(c) Take entire responsibility for the results. In the long run this policy will produce better pavements and at lower costs, than will the apparently attractive, but misleading, maintenance guarantee system.

The Beargrass Intercepting Sewer, Louisville, Ky.

NO QUALITY of modern engineering is more marked than the very great attention now given by the best men to the most careful study of future growth that must be provided for in all adequate public works. In these constructions, as in the mechanical equipment of the industries, growth of population or of market constantly call for better facilities. Machines can pretty easily be scrapped, but an inadequate sewerage system, so planned that it must be utterly discarded, is a more serious loss; its scrap value is a vanishing quantity.

The sewerage work at Louisville, Ky., furnishes an interesting example both of an outgrown, and almost valueless main sewer system, and of very careful planning for the growth of the city in designing of the new system under construction. An instructive example of adequate study of future needs, and provisions for them is given in the report of J. B. F. Breed, chief engineer, and Harrison P. Eddy, of Boston, consulting engineer of the Louisville work. The particular case is that of the sewer known as the Beargrass Intercepter.

The sewerage from about 7,829 acres, or twelve and one-fourth square miles, will be discharged into the intercepter. In determining upon the quantity of sewage to be provided for by the intercepter, the tributary area was divided into districts of three classes, residential, manufacturing and mercantile. After a very careful study of the topography and other conditions which will affect the nature of the development of the city, it was decided that it was reasonable to expect that 7,141 acres would be devoted to residential, 622 acres to manufacturing and 66 acres to mercantile districts. In the computations upon which sizes were based it was assumed that the quantity of sewage from the residential district would average 100 gallons per person per twenty-four hours.

To this quantity was added 1,960 gallons per acre per twenty-four hours as an allowance for unavoidable leakage of ground water into the sewers. From the manufacturing district it was estimated that provisions should be made for 24,000 gallons per acre for twenty-four hours, with the above allowance for ground water leakage. In the residential districts tributary to the Northwestern Trunk and Middle Fork Sewers, the estimated future population was 25 persons per acre, while in the remainder of the residential territory an allowance was made for 40 persons per acre.

Provision has thus been made for very much larger quantities of sewage than will be discharged from the trunk sewers for many years to come, in fact, the population of that portion of the city tributary to the intercepter at the time when it is developed to the extent assumed in these calculations will be 230,000 people and the population of the whole city will be close to 1,000,000. Where is a corresponding surplus of capacity in the manufacturing and mercantile districts.

Garbage Collection and Disposal in Minneapolis, Minn.

Editorial Correspondence

MINNEAPOLIS has a system of garbage collection and handling that is entirely free from nuisance. The garbage wagons as they pass along the street do not give off the customary odor that one is accustomed to expect; and at the transfer station there is not the nuisance common to such.

Each householder provides two cans of a size specified by the rules of the department. In one of these is deposited all ash, glass and like incombustible matter. In the other the common kitchen garbage is placed after being carefully drained of all water and wrapped in paper. This rule of drainage and wrapping is rigidly enforced. To the method of handling the wet garbage above described may be attributed the cleanliness of the wagons, and the sanitary conditions of the transfer and incinerating stations. The frozen garbage can and the half putrescent mass of garbage are entirely unknown in Minneapolis; and even in the summer time it is not necessary to collect more frequently than once each week.

The garbage is collected in two-ton, steel, covered wagons, of which there are thirty in service on regular routes. These wagons carry the garbage to the transfer station, where the wagon boxes are lifted off the trucks and placed on flat cars, to be conveyed to the incinerator. The accompanying photograph shows the method of handling at the transfer station. The average haul of the wagons is slightly over three miles. All trouble, complaints, special service calls, etc., are handled by a clerk in charge of the transfer station; and a regular card system of complaints is in use, giving the complaint, the testimony of the driver, and, in fact, all data needed in connection with each complaint. Failure to comply with the rules of the department results in the non-collection of the garbage, and a reporting of the delinquent party to the transfer clerk. Then if the person whose garbage has been passed should phone to make a complaint, a reference to the card of complainant shows at once why the can has been passed. This system further serves as a check upon the driver, who must show good reason for neglecting to gather garbage about which complaint is made.

DISPOSAL.

After being taken to the plant on flat cars, the wagon boxes are lifted by a three-motor crane, which conveys them into the building and dumps them into the charging hoppers. This carrier system is shown in an accompanying photograph. The three-motor crane permits of the back of the box being elevated as the front is lowered so as to dump and entirely clean the box.

The incinerator is of the Decarie type, of 300 tons capacity, and developing about 1,500 degrees of heat. It is operated straight through the twenty-four hours, the work being handled by three shifts. Two incinerators with basket grates burn the material. The basket grates are a notable feature. They consist, as the name implies,of a basket formed of three-inch piping placed parallel and joining on to a six-inch header at the bottom in such a way as to form a basket, permitting free and ready access of air to the charge and giving a hot flame throughout the grate area. Between the two grates is placed a Wickes tubular boiler with a Dutch oven attachment for making use of the hot gases in producing steam. An induced draft from a fan located in the small shed shown at the side of the stack furnishes the air for burning and a system of by-pass pipes permit of the regulation and distribution of this draft. The power derived from the utilization of the heated gases from the incineration amounts to about 500 h.p. and supplies the work house, the green houses, superintendent's house and the Hopewell tuberculosis hospital with light and power.

In 1901, when the incinerator was first constructed, it did not have the present efficient means of handling the garbage. At that time all the material was dumped into a large circular tank, from which it was carried on an interior conveyor to the charging hoppers. This tank is now used for shower baths for the employees, and the garbage is not left standing to create a nuisance. One factor that perhaps might be criticised is the

practice of making the prisoners at the work house open some of the garbage each day and sort out vegetable refuse for feeding the animals at the work house farm. This is the only instance of handling the garbage by hand in the entire process.

At present the plant is taking care of 100 tons per twenty-four hours; using only one of the two furnaces. The process produces about 3 per cent. of ash, and that in such a form as to be readily handled. The fuel cost is about six cents per ton, and the entire cost of disposal, not counting any income from the power utilized, is 35 cents per ton. After October first there is to be a charge of 3 cents per kilowatt for electricity and 8 mills per pound of steam used, charged against the work house, etc. This will reduce the cost of disposal to about 18 cents per ton.

To Dr. P. M. Hall, health commissioner of Minneapolis, is great credit due for the efficient and sanitary solution of the garbage question, and to his idea of draining and wrapping the garbage more than any other thing is due the absence of nuisance at all stages of the process.

Brick Roads at the International Road Congress

By Prof. E. D. Rich, Ann Arbor, Mich.

THERE appeared in *Engineering News*. under date of Sept. 1, 1910, an article giving the "final conclusions adopted by the Second International Road Congress at Brussels." It is fair to assume that these final conclusions represent a summary of the discussions which took place at the Congress. Inasmuch as there were present at that meeting some delegates—we are not informed how many—from the United States, it will doubtless come as a surprise to American road and municipal engineers that no mention whatever was made of the use of vitrified brick as a paving material, for both city streets and country highways. This omission would not have been so strange had the Congress been composed entirely of engineers and road experts from countries foreign to the United States where brick is so extensively and successfully used as a paving material, but with American road specialists present it is indeed a cause for wonder that they did not introduce into the discussions the experience of our road officials on this very important and useful material.

Had it been generally recognized by the Congress how fully vitrified brick as a paving material meets all the requirements for an ideal roadway, it would doubtless have received the most prominent place in the discussions of any method of road covering.

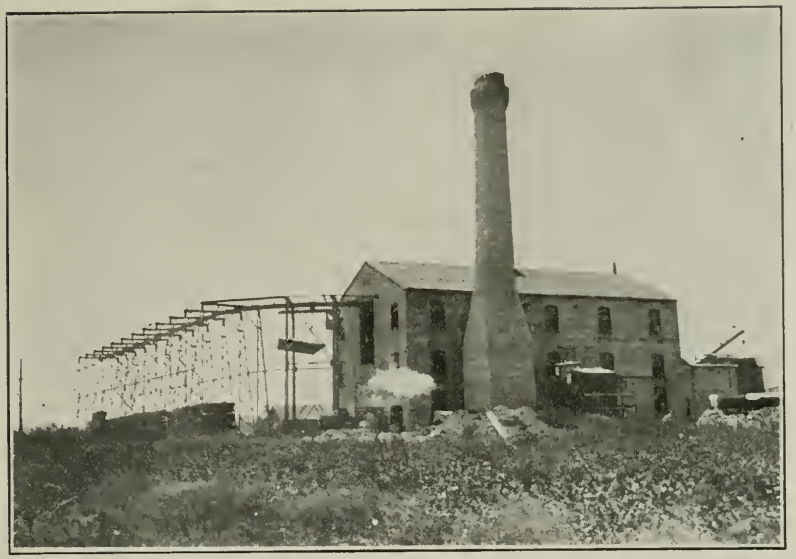
Let us see how brick compares in usefulness and durability with the paving materials mentioned in section 5 of the article above referred to.

In (1) waterbound macadam is admitted to be satisfactory only under exceptional conditions of very light travel.

In (2) macadam reinforced by any of the binding agents which have appeared in such vast varieties during the past few years, is classed purely as an experiment, and well may it be so classed until more than the present brief experiments of a year or two can be pointed to for justification.

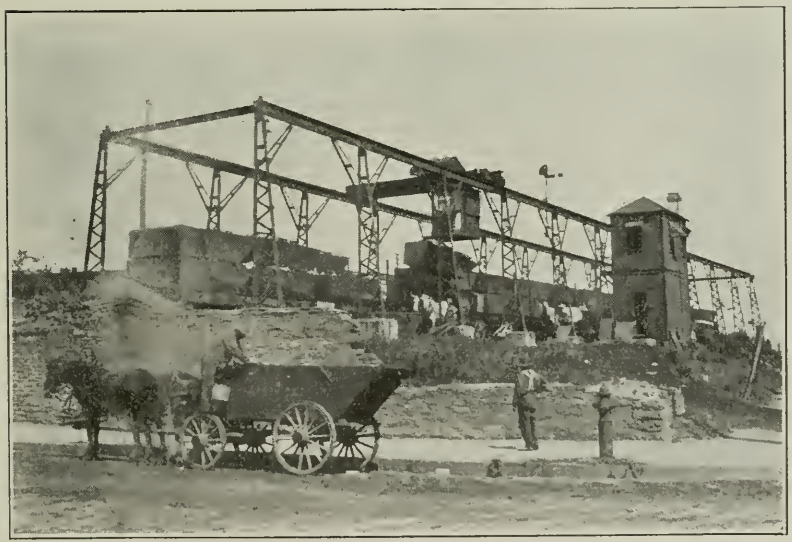
That brick paving has long since passed the experimental stage is conclusively demonstrated by the results obtained by the cities of Cleveland, Ohio; Terre Haute, Indiana; Paris, Illinois, and many others. When a brick street such as South Sixth street in Terre Haute can be seen with no measurable decrease in the depth of the brick apparent after twenty years of hard service under heavy traffic, the material and method of construction can hardly be regarded as an experiment. With such results attained, who can, with any certainty, predict its ultimate period of usefulness.

In (3) and (4) stone pavements are commended for their durability, ease and economy of maintenance, freedom from the production of dust and suitability adjacent to tracks. In this connection it is sufficient to say that a properly constructed vitrified brick pavement meets fully all these requirements, and in addition is much smoother than any stone pavement can possibly be made, rendering it far



GARBAGE DISPOSAL PLANT AT MINNEAPOLIS, MINN.

Apparatus for Transferring Garbage Wagon Boxes from Cars to Charging Floors of Furnace is Shown at the Left.



APPARATUS FOR TRANSFERRING GARBAGE WAGON BOXES TO CARS AT TRANSFER STATION, MINNEAPOLIS, MINN.

more easily kept clean and sanitary and reducing the noise problem to a minimum.

Those who are familiar with good block pavements will doubtless take issue with two of the statements made in (6). That it is not slippery is not at all borne out by American experience. That it stands heavy traffic is perhaps true for a time, but the life of this material has proved so short in many cases that it can not be said to be durable under any kind of traffic. The serious results of expansion, due to absorption of water after the preservative has evaporated is sufficient reason for its condemnation.

Hygienic qualities are mentioned in (8) as an advantage in the case of sheet asphalt, but just what constitutes a sanitary pavement is not enlarged upon. Medical knowledge and bacteriology have now fairly well demonstrated that certain diseases are communicated through the air, and are carried in clouds of dust. The germs of these diseases—for example, pneumonia, tuberculosis and influenza—find lodgment in the human body by way of the respiratory organs, and must be inhaled in order that infection may take place.

Another class of diseases, such as typhoid fever and cholera, are communicated by way of the digestive organs, and the germs must be swallowed to prove effective.

Still another class of germs, for example tetanus or lockjaw, obtain entrance to the human system through abrasions of the skin. Evidently the last two classes need not be considered in deciding upon a pavement which is sanitary, but the diseases of the first class, those carried in the flying dust to the nostrils of the people are so prevalent and so dangerous that no pains should be spared to reduce the dust nuisance to a minimum. This can be accomplished in two ways. First, by providing a pavement whose surface is constantly moist enough to prevent the dust upon it from being constantly blown about; and second, by constructing a surface which can be easily and thoroughly cleaned. The first result can only be accomplished by treating the roadway with a hygroscopic salt or with oil, both of which are unsuitable except on macadam parkways, boulevards and light traffic streets. The second method is the all important one. It is evident that the finer the particles of dust, the more easily are they carried by the wind, hence a method of cleaning must be adopted which will effectively remove the fine dust. Ordinary sweeping either by machine or by hand must be accompanied by careful sprinking in order to avoid an intolerable nuisance. If too much water is used the fine dust is plastered down on the pavement in the form of mud and if too little germs are stirred up by the sweeping process to form a menace to the traveling public.

Thus far only one practical way has been devised for successfully removing fine dust on a large scale, and that is by a thorough washing. Therefore, a street which can be satisfactorily washed must at the present time be considered the most sanitary. Sheet asphalt meets this condition well, but a properly constructed brick pavement with the cement filler of the joints intact and worn flush with the top of the brick is equally sanitary, for in this case there are no depressions at joints or anywhere else to retain dust. This highly desirable result can be obtained by a proper and careful attention to the details of construction if carried out as recommended by the National Paving Brick Manufacturers' Association. A copy of directions can be obtained, gratis, by addressing the secretary, Mr. Will P. Blair, 521-23 Board of Trade Building, Indianapolis, Indiana. A brick street built in this way is equal to asphalt in every respect, and in addition it is far more durable, it can be repaired without the necessity of the expensive tools, supplies and equipment required for asphalt repairs, and is ideal for use between and adjacent to car tracks.

In (10) further experiments with asphalt blocks are recommended. This field of investigation does not seem especially inviting, in view of the fact that the experience of many cities of the middle west has shown streets paved with this material in very bad condition at the end of five years. The fact that, in order to give sufficient hardness to make handling and shipping of the blocks possible, the asphaltic matrix must be mixed with so little oil that the life of the product is very materially reduced, will doubtless dampen the ardor of investigators along this line.

Editorial Note.—The International Road Congress, held at Brussels in July and August, devoted itself largely to the consideration of highways, city streets taking a subordinate place. The Indiana delegate, in his report of the convention, in

MUNICIPAL ENGINEERING, vol. xxxix, page 171, expresses his surprise at the omission of brick from the list of materials under consideration. This was undoubtedly because there are few good brick pavements in European countries. This country was represented by but few delegates who were sent for the purpose, and apparently there were none who were specially interested or informed concerning the successful use of brick in this country for highways. Comparatively few engineers and road builders have had the opportunity of examining the hundreds of miles of brick-paved highways radiating from Cleveland, and so there are very few who have seen the demonstration of their value and have been able to compare them with roads paved with other materials. Brick is no experiment and Ohio is now the demonstrator of its success on roadways, as it has long been on city streets.

Phalen Park Bridge, St. Paul, Minn.

By James Cowin, Minneapolis, Minn.

PHALEN PARK is situated about thirty minutes' ride by trolley from the heart of Saint Paul, and is one of the most beautiful of the large number of similar breathing spots which make the Twin Cities famous as a summer resort. The park embraces Lake Phalen, approximately a mile in diameter, and a considerable stretch of wooded, rolling country to the west of the lake, through which the Park Board has cut a number of lagoons and channels. These are spanned at intervals by foot bridges of wood and steel which will probably be replaced in time by more artistic structures of concrete and masonry.

Early in the spring of this year the Park Board laid out an automobile road through the park and, deciding to put in a bridge which would be substantial and monumental in character, they called for bids on reinforced concrete designs. The bid of Jacob Lauer, based on a design by C. A. P. Turner, of Minneapolis, was finally accepted. The completed structure is shown in the accompanying photograph.

The basis of the design is an arch between two piers supporting a flat slab. The span in the clear is fifty-five feet, with a height of twelve feet nine inches in the clear from the high water line, a horizontal line drawn through the intersections of the under side of the arch with the piers. The bottom chord is a segment of a circle drawn with a radius of thirty-six feet, while the top of the arch has a radius of forty-eight feet six inches. The longitudinal reinforcing consists of ¾-inch round rods, spaced eighteen inches on center at both the top and bottom of the slab. Five-eighths inch round rods are laid laterally across these, also at intervals of eighteen inches. The arch tapers from the middle as indicated by the two different radii, and is one foot four inches at the narrowest dimension.

The roadway proper is designed like an ordinary rectangular panel in a building, except that the thickness is slightly increased at the middle, at which point it is twelve inches thick. The total width is forty-one feet eight inches, and the over-all length of the roadway slab is one hundred and eight feet.

After the excavation for the piers was completed, centering was at once started. The system of centering was novel, and could only be used to advantage under special conditions, such as occurred in this particular instance. Mr. Lauer had a large amount of short length six by six timbers on hand, which represented the waste lumber from a former job. He cut these down to about four feet, beveled the ends and formed the pieces into arched girders much after the fashion that a masonry arch is constructed. A number of these girders were erected across the channel, and the pine centering was laid across them. An accompanying photograph shows this false work. As stated before, the lumber used was already on hand and much of it can be used again, so that it is impossible to tell the exact cost of this part of the work, but Mr. Lauer estimates the loss in cutting at approximately $400.

The steel was then placed as outlined, 16,442 pounds of various sizes of round steel being used, the labor cost averaging about $9 per ton for handling.

The piers were built of two-man rubble unified with a mortar composed of one part cement and two and one-half parts of sand. The concrete used in

the remainder of the structure was a standard mix, comprising one part of cement, two of sand and four parts of crushed rock. One thousand one hundred and twelve barrels of Portland cement were used, costing an average of $1.35 per barrel. Three hundred and fifty yards of sand, costing 80 cents a yard f.o.b. the site were required, and 672 cubic yards of crushed limestone were contracted for at $1.40 f.o.b. the tracks, 90 cents a yard more being required to get the material delivered at the bridge.

The entire labor cost amounted to $4,783, no effort being made to keep the various divisions of the work separate in this respect.

The ornamental railing is of artificial stone, and was furnished by the National Stone Manufacturing Company, of Minneapolis, and adds much to the appearance of the bridge.

Work was finished July 1, and St. Paul now has a bridge built at slight cost which has added fifty per cent to the appearance of the park, and which will last forever. There will be no maintenance costs and its beauty will increase with time, as its newness wears off and the ground assumes its original undisturbed condition.

PHALEN PARK BRIDGE, ST. PAUL, MINN.

ARCH CENTERING OF PHALEN PARK BRIDGE, ST. PAUL, MINN.

Pneumatic Tests of Cast Iron Pipe

By W. R. Conard, Burlington, N. J.

IN a paper before the Central States Water Works Association, held in Indianapolis on Sept. 20 to 23, Mr. W. R. Conard, of Burlington, N. J., tells of some interesting tests of cast iron pipes.

Two corporations, wishing to put in some pipe that would be absolutely tight when laid and in service, ordered from two separate manufacturers a quantity of pipe. In addition to the usual hydrostatic tests it was provided that each pipe should be carefully tested with air compressed to 50 lbs. per square inch, and that while under this pressure soap and water should be applied to reveal open or porous iron or defects. Because of this specification the companies submitted only the best grades of iron of a close and uniform texture.

The results were that in one case there were 4,954 pipe tested either hydrostatically or pneumatically; of this number 27 leaked under hydraulic pressure and 272 leaked under pneumatic pressure, those leaking under pneumatic pressure having already passed the hydraulic test; this makes a percentage of leaks of the whole quantity tested 0.545 of one per cent. for the hydraulic, and approximately 5.5 per cent. for the pneumatic, or slightly over 6 per cent. for the two tests. In the other case there were 2,737 pipe tested, of which 14 leaked under hydraulic and 186 leaked under pneumatic pressure; the percentage being 0.511 of one per cent. for the hydraulic and approximately 6.8 per cent. for the pneumatic, or about 7.3 for both.

Analyzing further it will be noticed that the percentage of hydraulic leaks to the total number was but about 6.2 per cent. of the total number of leaks, taking both jobs together. This proportion, however, would undoubtedly have been more evenly divided had the hydraulic pressure in testing been maintained for a longer period of time per pipe, for as previously stated air compressed will find its way through open or porous metal more rapidly than water compressed, but in view of the fact that all of the pipe were to be subjected to an air test subsequent to the hydraulic both manufacturers depended more on developing leaks with the air rather than with the water.

Mr. Conard recommends that the cast iron pipe used in water works piping should be subjected to this air pressure test, though the pipes under test were for carrying gas. He thinks that the ultimate economy will more than offset the present increase in cost necessary to obtain pipe that will pass the more exacting test.

The Concrete and Macadam Streets of Richmond, Ind.

THE concrete pavements in Richmond, Ind., are constructed much as ordinary brick pavement, except as to the top surface. The subgrade is prepared and the base laid exactly as in the case of brick, except that perhaps more care is given to the matter of sub-drainage as the injurious effect of freezing and heaving is more marked in the case of concrete paving than in that of brick. After the concrete base is set hard enough to permit of working over it, a layer of sand is spread over it and brushed off so as to fill the hollows in the base. Upon this is placed a layer of thin tar paper (or other suitable paper) to form a separating layer. Upon this is deposited the wearing surface in ½-inch layers, which are thoroughly tamped. This surface is a 1-1-1 mixture of cement, sand and clean limestone or granite screenings. This surface is troweled off and finished much as that of a sidewalk.

A report compiled by the city engineer of Richmond, Fred R. Charles, gives a complete statement regarding the conditions of the concrete pavements at the present time and the table of costs shows that the pavements closely approximate the ordinary sidewalk in expense of construction.

"The feasibility of using concrete as

a paving material for roadways is now being widely considered, and as Richmond was one of the pioneers in this line, we have received dozens of inquiries. In answer to these and as a matter of general interest, I beg to submit the following information:

"Our first concrete pavement was constructed in 1896 in the alley adjacent to the Westcott Hotel. Being a narrow alley, a large traffic was concentrated in a small space; nevertheless, after twelve years, this pavement shows almost no signs of wear. A slight sinking of gravel around the foundation of the hotel has caused a little settlement of the alley, but this, which would be disastrous with other forms of pavement, has only resulted in a slight unevenness of the blocks, which have not even cracked.

"In 1902, Sailor street was paved with concrete, and now is in almost perfect condition. In 1906 it was necessary to cut a trench the length of this street to lay telephone conduits, and the concrete was found so hard that it only could be cut with great difficulty. On completion of the conduits the pavement was very carefully repaired and now seems as good as new.

"In 1903 concrete was put down at North A street and Seventh, a very busy intersection of two principal streets, and in 1904 on Elm Place, a street adjacent to the Arlington Hotel and several wholesale establishments, which carries a great deal of heavy hauling, especially from the hardware and iron storage houses of Jones Bros. Hardware Company, which is claimed to be the largest and best equipped hardware store in the United States. These last two pavements were laid in large blocks with expansion joints one inch wide, filled with pitch. These wide joints are a disadvantage, since the edges of the blocks begin to chip a little at these places. With the exception of these places and a few temperature cracks, which cause no serious detriment, the pavements are in excellent condition, and will apparently last for years with no repairs or maintenance charges. On our later work we do not use the wide joint but

CONCRETE STREETS AND ALLEYS.

	Year.	Cost per Sq. Ft.	No. of Sq. Yds.
Alley east of the Westcott Hotel	1896	26.8	140
Alley 1st south of Main, 8th st. to alley east	1901	14	242
Alley bet. N. 15th and 16th sts, Main st., north	1901	17	162
Alley (private)	1901	15	222
Driveway No. 1, hose house	1902	20	88
Sailor st. from N. 8th to N. 9th st.	1902	14	644
Intersection on N. 7th and N. A st.	1903	16.5	481
Alley 1st south of Main, 19th to 20th st.	1903	15.9	333
(Street) Elm Place, N. 9th to N. 10th st.	1904	13	650
Alley bet. S. 8th and 9th st., Main to alley east	1904	15.5	184
Driveway No. 3, hose house	1905	15.5	88
Driveway No. 4, hose house	1906	15	88
Alley bet. S. 18th and 19th sts., from A st. north	1906	15	1142
Alley 1st north of Main st., from 6th to 7th	1906	13.3	311
Alley bet. N. 6th and 7th sts., from A st. south	1906	13.3	454
Alley bet. S. 7th and 8th sts., from Main st. south	1906	15	184
Alley south of Main st., 8th to alley east 6th	1906	14.5	700
Alley second south of Main st., from 5th to 6th st.	1906	15	300
Smith st. from S. 5th to S. 6th st.	1907	14.5	600
Market Place, cor. S. 6th and S. A sts.	1907	15	1611
Alley 1st south of Main st., 9th st. west	1907	15	247
Driveway No. 2, hose house	1907	16	170
Alley bet. N. 8th and 9th sts., N. A st. to Sailor st.	1907	13.75	170
Alley 1st north of Main st., N. 9th to N. 10th st.	1908	11.8	750
Alley bet. S. 6th and 7th st., Main st. south	1908	11.8	222
Alley 1st south of Main, S. 9th to S. 10th st.	1909	12	555
Alley bet. S. 9th and 10th sts., Main st. south	1909	12	226
Alley bet. N. 9th and 10th sts., from N. A st. south	1909	11.5	670
Alley bet. N. A and Main sts., from N. 7th to 8th st.	1909	11	663
Total area			11,856

find the ordinary sand joint satisfactory.

"In addition to those mentioned, we are constructing concrete pavements every year, more especially on alleys, which are in the busy portion of the city and carry a large traffic in the way of drays, brewery wagons, and other heavy hauling. This travel, concentrated in a small space, constitutes a more severe test than on streets where it can be more distributed. Our citizens are very well satisfied with this form of pavement.

"Contrary to asphalt and other materials, it is not damaged, but actually benefited, by water. Consequently it can be flushed with a hose and is very easily kept clean; an important item from an esthetic and sanitary standpoint.

"The initial expense is moderate. It cost us about 30 per cent. less than vitrified brick. Repairs and maintenance charges apparently will be nothfor a great many years, and the life of this material will doubtless equal or exceed that of brick.

"It is somewhat slippery for horses, about the same as brick. Many drivers prefer it to brick on that account, while others, of course, prefer the latter. Even when wet it is not so slippery as asphalt. It is significant that those who reside on these streets and use them most and have the best chance to observe them, are the most enthusiastic in favor of concrete."

The pavements mentioned in the report are most of them in splendid condition. The chipping mentioned is more noticeable along the longitudinal joints, where the tires of wagons have apparently slid and crushed the sides of the cracks to a certain extent. Even this fault is only found on those pavements where exceptionally wide joints have been made. It is a noteworthy fact that on those pavements where no central longitudinal joint has been made and where the slope is toward the center, cracks have formed, running along the center and branching to either side. These cracks are not so large, however, as to be troublesome.

Macadam Streets.—The conditions in Richmond are ideal for paving construction of any sort. The soil is sandy and most of the streets have been graveled and the gravel compacted. Most of the streets have concrete curb and gutter built where the street is graveled. The only preparation necessary for macadamizing the street is to remove a portion of the gravel on either side of a strip through the center and spread this central strip to make the foundation for the whole street. Upon this base is spread a layer of 6 to 10 inches of stone and the whole is compacted by wetting and rolling with a 16-ton roller. Care is taken to work towards the center so that the material is formed into the general crown desired. A layer of screenings and stone dust is then applied and wetted and the rolling again continued until, to use the street commissioner's words, "it's had enough."

The finished streets, some of which have been in constant use under heavy traffic for six or eight years, show very little effect of wear, except where a trench has been made for cross pipes, or where horses have been hitched along the curb and have worn hollows. The latter, however, are never deep and the material is not loosened and scattered. Water seems to have no effect on the surface, except where it is allowed to stand in pools; the dust is not any worse than from a brick street which is not regularly cleaned; and the main apparent value of the pavement is in its clean, white appearance, in its comparative noiselessness and in its cheapness and ease of construction.

AVERAGE LENGTH OF BLOCKS 350 FT.

Street	Depth of Stone (inches)	Width Feet	Stone Used Yds.	When Built	Cost Per Block	Remarks
N. 8th	8	35	388	1904	$177	Surface in fair condition.
N. 15th ...	7	35	...	1904	296	Cost includes cross walks. Condition excellent.
S. 11th ...	6	35	...	1904	312	Poor subgrade. Shows a few ruts.
S. C	6	25	418	1904	95	No haul for stone. Condition excellent.
S. 12th ...	8	35	1110	1904	343	Condition good.
S. 13th ...	6	35	366	1904	271	Long haul. Condition good.
N. 13th ...	6	35	443	1904	131	Short haul. Condition fair.
S. 18th ...	6	25	147	1902	129	Condition good.

The table given herewith is compiled from data kept by Mr. D. C. Green, the street commissioner, who has had charge of a great deal of the macadam work. Mr. Green has kept careful account of his material, labor, teams, roller fuel and tool repair, and each street has been charged with all items.

The stone used is at present obtained at a distance of about six miles, at a cost of 85 cents per yard, and the freight charges are about 20 cents per ton, so that the hauling after the stone reaches Richmond is really one of the large factors of cost. All work is done by the city under the supervision of the street commissioner and the engineering department, and all work is paid for out of the city general fund, except in the case where the improvement is entirely new. Labor is paid at the rate of 20 cents per hour, teams draw 37½ cents per hour, and the engineer on the roller gets 25 cents an hour.

The macadam streets are cleaned only once per year, and the method employed consists of scraping the dirt into the gutters with hand hoes and then removing it from the gutters. The total of 16.71 miles of macadam pavements were cleaned in 1909 at a total cost of $2887.50.

The preference of Richmond for the macadam pavement is shown in the following report of 1909 relative to street mileage:

Kind of Pavement	Previously Built	This Year	Total
Brick	1.52	0.00	1.52
Macadam	14.01	2.70	16.71
Cement	.20	0.00	.20
Graded, graveled and bouldered	33.12	1.47	32.16
Pike	7.13	0.00	6.35
Unimproved ...	8.62	0.00	7.66
Total Miles.....	64.60	4.17	64.60

The total mileage of improved roads shows the progressiveness of this city of 23,000 population.

Cement Streets of Fond du Lac, Wis.

By an Editorial Correspondent

In Municipal Engineering for August a discussion was given of a paper by J. C. McCullough, city engineer of Fond du Lac, Wis., on cement streets. Some further comment on the points of difference in these and other cement streets might be of value.

The preparation of the base and 5-inch concrete foundation is identical with the process employed on other forms of pavement. After this foundation has been placed and before it sets, a wearing surface 1½ inches thick is placed upon it. This wearing surface consists of 1 part of Portland cement, 1 part of clean, sharp sand and 1 part of granite screenings. This layer is then brought to an even surface, troweled, and a steel broom is dragged across it so as to bring the coarser particles to the top and to give a rougher face. With the exception of a transverse expansion joint placed at 50-foot intervals (or less) there is no break in the surface of the pavement between the curbs.

The fact that granite screenings and sand are both used in making the top coat is intended to prevent the surface from becoming slippery. It may be said to be very effective in this particular. The theory set forth in this particular combination for the surface coat is, that the cement and sand particles will become worn away leaving the screenings protruding so as to roughen the surface. This is in fact what takes place and the pavements even when newly sprinkled are by no means slippery. One test block in the city engineer's office was ground against a wheel used in a tombstone factory for polishing stone. This piece exhibited particles of granite exposed varying in size from ¼ of an inch to the finest.

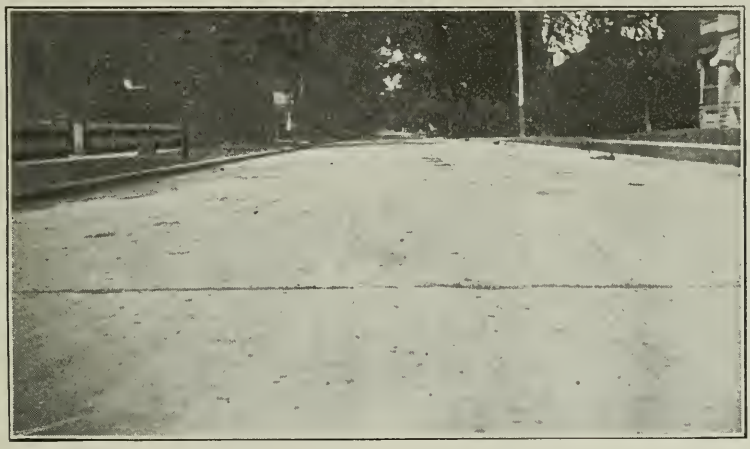
It is the practice in Fond du Lac to provide cement streets only where they are petitioned for by the property owners. The fact that at the close of this year there will be 8.6 miles of cement streets built at an average cost of $1.21 per square yard is the best testimony to their having given satisfaction in Fond du Lac. The amount of cement street work done each year reaches close to $100,000.

Fond du Lac claims the superiority of her cement streets over other types in the matters of durability, of sanitation, and of lack of slipperiness. Dur-

ability has not yet had a thorough trial, as the oldest pavement has only been built about two years. An accompanying photograph shows one of the streets constructed in 1908.

In the older pavements a great many cracks have formed, most of them running in the general direction of the street and near to the center. These cracks and the edges of the expansion joints are chipped and worn to a noticeable degree. The hollows are filled with dirt, as may be noted from the accompanying photograph. But even this would seem to be superior to having a number of transverse grooves to become filled with refuse and to make sweeping difficult. The matter of longitudinal cracks is at present receiving attention and a reinforcement of triangular net wire is being placed between the foundation and surface of the pavement.

Most of the cement pavements of Fond du Lac are in splendid condition and the conservative statement of the city engineer that they are a good "cheap" pavement seems entirely true.



CONCRETE STREET IN FOND DU LAC, WIS.
Transverse Joint, Showing Wear.

CONCRETE STREET IN FOND DU LAC, WIS.
Note Transverse Joints and Longitudinal Cracks.

EDITORIAL COMMENT

City Refuse Collection.

State Control of Sewer and Water Systems.

CITY REFUSE COLLECTION.

The long neglected problem of the collection and disposal of city wastes has at last been attacked in something like a scientific manner and some fairly satisfactory results have been obtained, so far as disposal is concerned. There is too much tendency toward imitation in this, as in other municipal matters, with resultant total or partial failures where conditions are so different that the methods used in one city cannot be applied in another. Most of these failures are due to the differences in methods of collection of refuse and in the matters included in the collections.

The fact is that the collection of the refuse is quite as important a matter as its disposal, and may be quite as much of a nuisance, although it may be so scattered in place and time as not to give rise to serious objections. The various classes of refuse may be described as follows:

Garbage, meaning animal and vegetable refuse which attends the preparation of food for consumption, is large in amount and productive of great nuisance if not properly taken care of. It is therefore the main object in view in considering the disposal of the city's wastes, always excepting sewage as otherwise taken care of. There is a certain amount of value in garbage, which attracts the attention of many, and reduction systems, feeding of hogs, etc., have been used to rescue this value. From the point of view of this value, the garbage of cities varies greatly, and the garbage from different parts of the same city varies greatly. The garbage from hotels, restaurants, large boarding houses, flats, etc., where it accumulates rapidly enough to warrant removal at frequent intervals, is of high quality, and but little fermented, and has a commercial value often sufficient to warrant private contractors in removing it without charge or even paying a small sum for the privilege of removing it. In the latter case the garbage is, in the full sense, property, and under Pennsylvania decisions is under the control of its owner, subject, of course, to reasonable rules and regulations regarding its sanitary storage, removal and disposal. The garbage from residences generally does not accumulate rapidly enough, nor are these accumulations close enough together, to make the material of sufficient value to warrant any one in collecting and disposing of it without charge, not to speak of paying for the privilege. This class of garbage is, therefore, a constant source of expense to the householder, if he must pay for its removal, or to the city, if there is a general public system of removal. It can hardly be classed as property, and is subject to the control of the city council and the department to which the operation of the garbage disposal system is intrusted.

Commercial garbage includes not only the garbage from hotels, etc., above referred to, but also the refuse and spoiled materials from markets, vegetable and fruit commission houses, groceries, meat, fish and fowl shops, and slaughter house sand docks. Some of these wastes have considerable value.

Manure is another kind of refuse which has a certain commercial value in some cities, but is sometimes, especially in the larger cities, difficult to dispose of for the householder who has but a single animal, so that it must sometimes be added to the refuse to be collected by the scavenging department of the city.

Dead animals have a value which,

in the case of the larger animals, may be sufficient to make them property in a real sense, for which a small sum may even be paid. The small animals ordinarily find their way to the garbage disposal plant.

The ashes of a city usually amount to a larger tonnage than all its other refuse. If kept by themselves, they are clean and wholly unobjectionable, except as they may be so handled as to produce dust in handling, carting or depositing. They have a considerable proportion of unburned or partly burned coal, which is sometimes considered worth saving. Ashes and cinders from manufacturing plants have less coal, but are sometimes available for making porous foundations for walks and the like or for making concrete, and so may have a certain property value.

Street sweepings are often treated in the same way as ashes, i. e., used for filling. Paved streets which are crossed by unpaved streets have a large proportion of inorganic matter in their sweepings, and the organic matter is probably largely manure, so that the street sweepings can be used for filling, if the health department will keep the process under inspection and see that the materials and methods of depositing them conform at all times to sanitary requirements. If hand labor is used in picking up droppings during the day, their collections may be treated as manure is treated.

There is a considerable volume of refuse from a city which is not included in any of the classes above described. Its weight is comparatively small. This refuse, most of it, is reasonably clean, though some of it, for example, mattresses from sick rooms or hospitals, may be dangerous from a sanitary standpoint. Much of this matter is combustible, but some of it is not, and may be objectionable about a disposal plant. Some of it is commercial in the sense that it has sufficient value to warrant private collection, but, especially in households, the quantity and regularity of production may not be such as to bring it into the commercial class.

The combustible refuse consists of paper, wood, straw, grass, tree trimmings, mattresses and other cloth, etc. Mercantile and manufacturing establishments may have enough such material of commercial value to derive quite a revenue from its sale.

Incombustible refuse includes such household waste as tin cans, bottles, broken crockery and glass, leather, metals, remains of building repairs, etc., besides occasional earth, brick, cement, mortar, etc., the result of more extensive building or repair. Some of this material is of sufficient value to make fortunes for the junk men who go about gathering it up, and the remainder is probably not any more objectional than ashes for use as filling. Such material as cans, broken crockery and glass are difficult to dispose of, because they are not wholly satisfactory as filling and are not destructible.

Night soil is a class of municipal refuse which should rapidly become less in amount. A city with complete municipal sewer and water systems should be able to enforce water and sewer connections so that such deposits need seldom occur, and the board of health, by a strenuous campaign, could substitute the earth closet for the vault, where something is necessary, and thus reduce the nuisance of disposal. The nuisance of the earth closets would not be greater than that of the vaults now is, and it is readily subject to control by inspection, while the latter is very difficult of control. The amount of material to be removed would be greater, and it might be necessary to furnish the dry earth, but in the very small sections of the city without sewers, and during the comparatively short time before the sewer and water pipes are extended, the earth closet system should be a great improvement over the vault system. The board of health doubtless can, and certainly should, make it impossible to have a deposit of night soil in areas having sewers and water.

It is evident that these various classes of refuse will vary greatly in

amount in various cities and at various times of the year. It is also evident that opinions of property owners, city officials, contractors, and others interested, will differ as to the value of the various classes of refuse and as to what should be done with them for the purpose of extracting this value at the same time that the nonproductive parts are disposed of. Too often this attempt to save results in nuisance or danger to health far greater than any actual saving.

Whether each class of refuse shall be collected separately, or two, three or more together, is a question of importance, both as regards cost and sanitary conditions, and as regards the method of disposal adopted. It is evident that the method of disposal depends directly upon the method of collection adopted and that the two are inseparably connected. Unfortunately, this connection is too often overlooked, and the disposal plant is a failure through no fault of its own, but because it has not been chosen to suit the conditions existing.

There are almost as many variations in the methods of separating and collecting refuse as there are combinations of the kinds of refuse above listed, no two cities agreeing exactly in these matters and practically all of them having radically defective methods of collecting one or more of the classes of refuse. The description of the method of collection of garbage, combustible and incombustible refuse, and ashes, in Minneapolis, given on another page of this number of MUNICIPAL ENGINEERING, shows a system far better than the average, but one which should not be followed blindly. Descriptions of other methods of collection will be given from time to time.

The purpose of the writer will be effected if the emphasis put upon the necessity of adequate methods of collection of the city's refuse will lead to the same careful study of the subject in each city that has been given to the disposal of the collected refuse in a few of the cities of the country.

STATE CONTROL OF SEWER AND WATER SYSTEMS.

The state of Kentucky has been added to the list of states exercising more or less control over the pollution of streams by sewage and over the purity of water supplies, bringing the number of such states to about one-fifth the number in the Union. Kentucky has not given its State Board of Health much more power, or money, than its latest predecessor, Indiana, gave to its sanitary authority, but the state has provided for a state sanitary engineer, the first incumbent of the office, Paul Hansen, taking the office September 1.

The State Board of Health has provided work for the engineer's office to the limit of the appropriations by adopting rules requiring the submission to the board of plans for sewers and water supplies, for changes in methods of treating water, for changes in methods of disposing of sewage, for location of sites for industries producing putrescible or otherwise objectionable liquid wastes, and for treatment of such wastes.

The last named rule is apparently aimed at the numerous distilleries in the state, the refuse from which is producing very serious nuisance in several localities.

Mr. Hansen will doubtless follow the general plan in use by the State Board of Health of Ohio, with whose work he has been connected for several years, and his experience and the limitations of funds may make progress in the work slow enough so that the education of the people and the legislature may keep up with it. If not, there may be such setbacks as have occasionally occurred in other states on account of antagonisms aroused among those affected financially by the new restrictions. When public opinion is not sufficiently educated, the results of such antagonisms are the repeal of the laws objected to or the withdrawal of appropriations. They also cause such delays in the passage of salutary laws extending the powers of the State Board of Health

as have been experienced recently in New York, laws which have not yet passed the legislature.

The public will support health laws when it sees their desirability, but will be indifferent to attacks upon such laws so long as it is ignorant. The main business of the Board of Health is therefore educational, and steady progress depends upon the ability of the leaders to take advantage of every opportunity for improvement in the laws, but at the same time good judgment in choosing the limit of advance at any such opportunity, so as not to get too far ahead of the main army.

THE QUESTION DEPARTMENT

Mechanical and Slow Sand Filtration of Water.

We want to ascertain the relative difference between the slow sand system of filtration and the mechanical system as to cost of installation, maintenance and durability.

A. H., Darby, Pa.

This question is not easy to answer in a general way. For any particular case general plans can be made and the two systems compared with reference to the local conditions, but these conditions vary so much that what is a proper system for one location may not be so for another. The following general observations may be of some value, however.

Slow sand filters require much more area than mechanical filters, and where cost of site is a large item may make the former cost much more than the latter, since the former filter water at the rate of 100 to 150 million gallons per acre per day and the latter at 2 to 6 millions.

Cost of construction of slow sand filters varies with the grading required, whether the filters must be covered or not, etc. Buildings and connections are the principal variants in a mechanical plant of like capacity.

In considering the cost of operation and maintenance of the filters there are so many variable items that data from operation of plants can be compared only with the fullest knowledge of the local conditions. An important factor is the rate at which the filter can be operated and produce the necessary purification and another the rate at which the filter clogs and requires cleaning. It is evident that, given two plants with the same cost of operation, if one has so much better raw water than another that it can be filtered at twice the rate, the cost of filtration will be only half as much per million gallons. The first cost will be greater in the case of the less pure water, because of greater area required to allow time for cleaning and for fluctuation in rate of demand for water. More frequent cleaning will be required, so that the cost of operation must be corrected for this expense also. This cost of cleaning varies greatly, in the slow sand filters the scraping of beds becoming necessary at intervals of 9 to 40 days according to purity of water, or a filter may require scraping after filtration of 25 million gallons in one case while in another it may filter 150 million gallons or more before requiring cleaning. The same principle applies but in different proportions in the case of a mechanical filter. Chemical treatment and sedimentation also greatly modify the rate of filtration and the frequency of cleaning filters.

Skill in operation has much to do with the cost of filtration.

With these warnings as to dangers in making comparisons between plants under different conditions, the following figures, gathered from various sources, may be given:

A cost of $30,000 an acre for slow sand filter beds is stated by Hazen as an average of American construction, with great variations and in the smaller plants an excess over this figure, in some cases, of 100 per cent. or more. If covered, the cost of filters will average near $50,000 an acre and may run to $75,000 as in Washington, D. C. The cost per million gallons of capacity would vary roughly from say $10,000 more or less for uncovered reservoirs to somewhere between $15,000 and $30,000 for covered reservoirs.

Mechanical filters cost $500,000 to $800,000 an acre of filtering area, the

latter figure including reasonably good buildings, or say $8,000 to $12,000 per million gallons capacity.

The mechanical filters operate so much more rapidly that the filtering area is much less than for slow sand filtration and the total cost of plant is only some 20 to 35 per cent. of the cost of the latter.

In Hazen's "Filtration of Public Water Supplies" ($3) will be found a diagram showing the cost of clarifying water by mechanical and sand filters for the special set of conditions at a plant not named and the conditions not definitely stated, which will show the impossibility of making comparisons of cost of operation in different plants unless all conditions are known and allowed for. From this diagram, if the water applied to the filter has 0 turbidity sand filtration will cost for operation only about $1.15 per million galons and mechanical filters will cost $1.60. But if the turbidity is 0.50 the clarification by mechanical filters will cost $4.55 and by sand filters will cost $6.85 per million gallons. He adds $3.50 to each as the cost of operation to produce a bacterial efficiency of 98 per cent. in purification of the water. Interest on cost of plant would make the total cost of maintenance more favorable to the mechanical filter. The general statement is made in Fuertes's "Water Filtration Works" ($3.50) that while the cost of installing a covered slow sand filter plant is from three to five times the cost of a mechanical filter of the same capacity, the total annual cost of operation is about the same, chemicals and greater allowance for deterioration in the mechanical plant offsetting the lower interest charges.

Cost of operating American slow sand filters varies from $2 to $3 per million gallons filtered.

London's average for 15 years was $1.24 per million gallons.

The average cost at Poughkeepsie for 20 years was $2.99 per million gallons, but of late years this has been greatly increased. Mt. Union averaged $2, Lawrence $5.80 before covering, over 40 per cent. of which was for care of ice on the filter in winter.

Turneaure and Russell's "Public Water Supplies" ($5) states that, including interest and depreciation the total cost of slow sand filtration may, under ordinary circumstances, be estimated at $7 to $9 per million gallons filtered.

Cost of operating a mechanical filter plant, according to Turneaure and Russell, is from $4 to $6 per million gallons under ordinary circumstances, and, including interest and depreciation, the total cost will run from $10 to $12 per million gallons.

As above stated, the cost in any individual instance may vary much from these statements of averages, and the two systems of filtration may change places. This is probably the case in many of the smaller plants, where cost of operation and of expert supervision of the operation of a slow sand filtration plant may very largely exceed that in the less sensitive mechanical plant, which may require only occasional visits from the supervising expert. There are very few slow sand filtration plants in small cities and there is little information concerning their operation. A description of the new plant at Ashtabula, O., is given in MUNICIPAL ENGINEERING, vol. xxxvi, p. 284. Results of operation of the open sand filters at Reading, Pa., are given in vol. xxxv, p. 252. One of these filters has only 250,000 gallons capacity per day and all costs of operation, not including capital charges but including cost of handling ice, amounted to $3.57. The other filter of over 3 million gallons capacity cost $3.31 per million gallons to operate.

Of the larger plants information is given in vol. xxxvii, p. 410 about the Washington plant, on p. 145 about the Pittsburg plant, on p. 245 about the new Toledo plant; and in vol. xxviii, p. 97 about Toledo and p. 387 about McKeesport. Lists of other articles on filtration and filtration plants will be found in vol. xxxvi, pp. 109 and 315.

Information About Water Pumping Plants.

Kindly send me list of issues of MUNICIPAL ENGINEERING for about a year back containing articles on water works, pumping plants and machinery, steam or electrically driven.

C. H. R., S. Framingham, Mass.

The following are the most important articles on this subject in the last wo volumes and the current volume:

Vol. xxxix: "The Water Works of Madison, Wis., p. 6; "The Water Works of Springfield, O.," p. 97.

Vol. xxxviii: "The Water Works of Marion, Ind," p. 4; "The Combined Electric Light and Water Works of Thomasville, Ga.," p. 249; "Lowering Water Level in Wells of Frankfort, Ind.," p. 256; "The Electrically Driven Water Works Plant at Mattoon, Ill.," p. 402.

Vol. xxxvii: "Valuable Data Regarding Water Supplies," pp. 258, 330, giving data regarding numerous water supplies in cities of 25,000 to 50,000 population, but little regarding pumping plants.

All these articles except those on Thomasville and Frankfort can be supplied at 25 cents each.

Cost of Pumping Water.

You would confer a special favor to me if you will give me information on what would be a reasonable price for pumping the water from the lake into the standpipe for one year. We have about 600 families as water takers and 2 flour mills and a flat, and 3 livery stables on meter. We have been paying $600.00 until 3 years ago; were then compelled to pay $1,000.00 per year; and now, the power plant asks further increase on the price

of pumping to compel the water works committee of the city of Boonville to pay over $2,000 for pumping. The city furnishes the steam pumps and keeps them in repair. G. S., Boonville, Ind.

This question cannot be answered without further information. It is possible that for the lift and other conditions existing at Boonville the cost of power for pumping water would be from $5 to $8 a million gallons. If the consumption were 300,000 gallons a day the first figure quoted in the inquiry would fall between these limits. If the consumption were 1,000,000 gallons a day the last figure would not be far wrong. It should be possible to make an estimate of the consumption by keeping a record of the pump performance or of the level in the reservoir for long enough time to give data for a reasonably accurate computation.

The cost of power stated is somewhere near the average and the cost in Boonville may be very different, as the range extends below, and in a few cases far above the figures given. The local conditions must be taken into account in fixing a fair price. A competent engineer can soon determine the actual cost of furnishing power, and the amount of power to be furnished can be ascertained by him after a comparatively brief investigation. The city would probably save money on a new contract by putting the determination of the price to be paid in the hands of such an engineer.

Boiler Capacity for Small Water Works.

Our city is about to install boilers at the water works plant. The idea is to have duplicate boiler power. The question arises as to what is the necessary horse-power required. As I see it, the best way to get at it is to put the horse-power required per standard fire stream based on 1¼ inch nozzle and 80 lbs. pressure at fire plugs, and in putting it in this way the council can readily see how many streams of water they want, and the question will be settled as to what they may expect. Pumping is done with common high pressure duplex pumps, with 5 miles of water main. Pumping plant is centrally located. We have agreed to submit the proposition to the Editor of MUNICIPAL ENGINEERING to be published in the Question Department of the next issue. JAMES O'ROURKE.
Supt. Water Works, Fulton, Ill.

This is a very general question and can be answered only in a very general way. The lifting of the water for the fire-stream named would require about 12 net horse-power and the energy in the steam applied at the engine must be, say, 20 horse-power in order to overcome friction in machinery and pipes, leakage, etc. If we assume average conditions for good installations in good order, one fire-stream might require 20 horse-power of boiler, but if conditions are not good, if losses are great, if efficiencies are small, if boilers or machinery are not in good order, the amount of steam made by the boiler may be increased by 50 per cent. in order to furnish the fire-stream required. Probably the horse-power of boiler required for one of the fire-streams named would lie between 15 and 30 according to conditions of operation and character of design.

There are numerous factors about which no information is given which will greatly influence the answer to the question, such as the regular pumpage for the every-day uses, the sizes of pipes and hydrant branches, to mention but two. If the pipes are small the above answer would apply only for the first fire-stream or two, and the horsepower required for additional streams would increase materially on account of the additional friction in delivery of the larger quantities of water and the additional pressure required at the pump to overcome this friction.

The fire-stream named is only a fairly good stream, but is probably sufficient for a small city with few buildings more than two stories high.

Books on Sewerage and Sewage Disposal.

Please give me the name of the best recent work on construction and maintenance of sewerage systems, including septic tanks.
A. B. M., Texarkana, Ark.

Folwell's Sewerage ($3), Wiley & Sons., and Staley and Pierson's "The Separate System of Sewerage" ($3) are both good books, giving many good points on design and construction as well as on the theory of the subject. The latter of course has to do with the separate system entirely. The first mentioned book (Folwell's) has just been issued in a new edition and is the latest publication on the subject of sewerage and sewage disposal.

Other good books will be found listed in MUNICIPAL ENGINEERING, Vol. xxxiii, p. 175.

Specifications for Sewer Construction.

I am preparing plans and specifications for the installation of a system of sewerage in a small town near this city, and am anxious to secure copies of standard forms of specification covering the various branches of the work, viz, excavation and backfill, pipe laying and building of man holes and catch basins, furnishing of terra cotta pipe, and furnishing of castings. There is also a small portion of the town which it is proposed to drain into a septic tank or to treat in some other manner. Could you furnish me with any copies of specifications covering any portions of the above, or refer me to such in your very valuable paper?
G. M., ————, N. B.

There is a brief outline of the points that should be covered in sewer specifications in MUNICIPAL ENGEERING, vol. xvii, p. 23. Some of the provisions of Pittsburg sewer specifications are discussed in vol. xix, p. 95. Specifications for brick for sewer construction are given in vol. xxiv, p. 430. Specifications for laying

sewer pipe are given in vol. xl, p. 35. Abstracts of specifications for concrete sewers of various sorts will be found in vol. xxii, pp. 19 and 169; vol. xxiv, p. 253; vol. xxv, p. 182; vol. xxvii, p. 248. A list of articles descriptive of concrete sewers in various cities is given in vol. xxi, p. 450. Specifications for concrete sewers are given in vol. xxxii, p. 314, and for concrete pipe on p. 164. Specifications for reinforced concrete pipe are given in vol. xxxv, p. 318. An article on "Methods of Sewer Construction in Clinton, Iowa," vol. xxxvi, p. 300, gives some good suggestions for sewer specifications. Brooklyn specifications for concrete pipe sewers are given on p. 384.

An excellent set of specifications for sewers and sewer materials will be found in Folwell's "Sewerage" ($3), a new edition of which has just been issued. Specifications applicable to septic tank construction will also be found in the book.

Treatment of Brewery Waste.

Can you advise system of treating trade waste from a brewery? It is not the intention to treat it primarily to discharge into sewers but for purification before discharging into stream. I would thank you for any data or name of publication you can give.

THOMAS PEALER,
Borough Engineer, Indiana, Pa.

The principal difficulty in treating brewery waste is in the souring of the waste before it is subjected to treatment. Naylor's "Trades Wastes" is an English book on their treatment and he describes therein a system of treating brewery waste in an auti-souring tank. The process is stated in brief in a review of Mr. Naylor's book in MUNICIPAL ENGINEERING, vol. xxv, p. 123. It is also given in brief articles in vol. xxii, p. 179 and vol. xxv, p. 34. The tank is fed by a constant flow of a small amount of house sewage, the bacteria in which counteract the souring of the brewery waste, and as a result the effluent from the tank is comparatively odorless and can be purified by filtering through coal, or can be discharged into a city sewer.

How to Prevent Slippery Sidewalks.

The City of Holly Springs is laying concrete side walks. And owing to numerous undulations and hills, grading will be out of the question. Now how best to obviate slick pavements in the winter, caused by freezing, is the question. Can you suggest a satisfactory remedy without grading. A corrugated surface is not desirable if something else will do as well or better. F. E. WEST, Mayor.
Holly Springs, Miss.

Cement sidewalks seem to work well, even in northern climate, on grades of 5 or 6 per cent. and as far south as Holly Springs there should be but few minutes in the year when grades even as steep as 10 per cent would make them objectionably slippery. Unless the city has very steep hills it should be possible to reduce grades within these limits with very little excavation. If the hills are so very steep, an occasional step or several of them can be put in, in which case the walk between steps should not be given more than, say 5 per cent. slope.

Will our readers give the results of their experience as to slipperiness of walks on grades such as those mentioned or steeper?

Who Makes Peet Valves?

Can any of your readers give me the information who manufactures the water works gate valves which are marked, P E E T? These valves have been in use for the past twenty-five years.
W. P., Supt. Water Works,
———, Mass.

Crown for Brick Street.

Will you please tell me what the height of crown should be for a 47-foot brick street which is in a business district and on flat grades? W. B. HOLMAN,
Rochester, Ind.

Various allowances are made for crown of street from ¼ inch per foot of the half width of street, which would give nearly 6 inches for the crowd of a 47-foot street, to the Omaha formula for crown in which 4 times the per cent. of the longitudinal grade is subtracted from 100, the remainder is multiplied by the width of the street and divided by 5,000, which gives 11¼ inches for the crown of a street with a level longitudinal grade. The modern tendency is for lower crowns, especially for block streets, so that 6 to 8 inches should be sufficient on a street in a business district. However, the cleaning of streets has something to do with the crown and if the streets are not kept clean the crowns should be increased toward the higher limit named.

Lists of American Water Works Systems.

Do you publish a list of water works throughout the United States and Canada, especially those which are equipped with pumps and not operated entirely by gravity system?
J. B., Philadelphia, Pa.

The "Manual of American Water Works" ($1.50) contains such a list, with full discussion of apparatus, etc., but the last edition of this work was issued in 1897, so that it is rather out of date. The "Engineering Directory," published by *"Domestic Engineering,"* of Chicago ($5.00), contains a list of water works, which is quite complete so far as cities of more than 10,000 population are concerned. This list is kept up to date, but it is very brief. There is also the "Municipal Year Book" ($1.50), the first and only edition of which was published in 1902, which contains information regarding all the utilities of cities of more than 3,000 population. It states in each case whether the water supply is by gravity or by pumping.

Concrete Reservoir Lining.

Not being posted in doing concrete work, putting better floors in two reservoirs, approximating 20,000 square feet, I would thank you very much for the following information:

1. Will Black Diamond serve well under water? It is made at Sellersburg, Ind. We can buy it f.o.b. here at 81 cents, 285 pounds in wooden barrel.

2. What is best mixture of cement, sand and gravel, or 2-inch macadam rock, if Black Diamond is suitable.

3. If not, what Portland is best suited for reservoir bottoms?

A. S., ————, Ky.

1. Black Diamond is a natural cement of the Louisville group. Natural cement may be used where it is entirely submerged under the low water mark, or where there is no danger of its being exposed to the action of the weather by cutting away the surrounding earth. It may be used where there is a firm and uniform foundation and where it is not exposed to the wearing action of the water, as natural cement concrete does not possess great strength, nor does it offer great resistance to wear. It should never be used in reinforced concrete work. Black Diamond brand has an excellent reputation as a natural hydraulic cement.

2. With regard to the best mixture for natural cement concrete: 1 part of cement to 2 parts of sand and 5 part of crushed stone (or gravel) gives a good mixture. Wherever a stronger mixture is required a 1:2:4 proportion is recommended. If Portland cement is used a 1:3:6 or a 1:2½:5 mixture may be used. In using natural cement the gravel concrete has one-half to three-fourths the strength of the broken stone concrete; while with Portland cement there is little difference, though the broken stone gives a stronger concrete. Gravel concrete made with natural cement increases in strength with age.

3. Reference may be made to the "Business Directory" published in each number of MUNICIPAL ENGINEERING, under the heading "Portland Cement," for names of manufacturers of cement suitable for reservoir work, in event that it is decided that natural cement will not give sufficient strength. Under the heading "Cement" will be found also names of dealers in and manufacturers of natural hydraulic cement.

It would seem that the main point under consideration in the construction of these reservoir floors would be the matter of preventing leakage. The first factor to consider in this case is to get a mixture of cement, sand and gravel, so as to obtain a minimum of voids. The above-mentioned proportions are of course general and are made with the matter of strength rather than watertightness considered. The correct proportions with reference to minimum voids vary with the material at hand and may be determined exactly, only by making a sieve analysis of the gravel and sand to be used. Some good waterproofing compound might be used to advantage also. Any one of the common forms of compounds to be mixed with the concrete may be used; or the bottom of the reservoir might be coated with some asphaltic waterproofing compound. Either method has been found to give satisfaction when properly applied.

Standard Specifications for Portland Cement.

In your issue of April, 1910, you print the report of the Committee of the Organization for Standardizing Paving Specifications, especially in regard to concrete pavements. They report that the tests and requirements for Portland cement shall be the same as those adopted August 16, 1909, by the American Society for Testing Materials. Now would it be asking too much of you to procure me a copy of this cement requirement? Or advise me where I can obtain same?

H. H. T., Norfolk, Neb.

Copies of the standard specifications and methods of test of Portland cement adopted by the American Society for Testing Materials can doubtless be obtained of the secretary of the society, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.; also of the Association of American Portland Cement Manufacturers; also of most of the manufacturers of Portland cement listed under the heading "Portland Cement" in the "Business Directory" printed in each number of MUNICIPAL ENGINEERING. The "Handbook for Cement Users" ($3) contains the specifications adopted by the American Society for Testing Materials, complete, except the slight and unimportant changes made at the 1909 convention of the society.

Richmond's Loss on Improvement Bonds.

From a leakage in the improvement bond fund of the city, due to the failure to call in bonds when property owners had made full settlement in advance of their waiver period, and the consequent payment of interest for subsequent years by the city, it is stated there is an aggregate loss in excess of $21,000.

Under the Barrett law where property owners take ten years to pay for their assessments, bonds are issued which bear five per cent. interest. It develops that in hundreds of cases property owners have tired of the installment plan, and within a period of one to five years, have made full settlement. It also is revealed that the city, instead of calling the bonds issued against these particular assessments, has permitted them to run a full ten years, and the interest theeron has been paid out of the general fund of the city, instead of out of the pockets of the property owners.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Bituminous Filler Again.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Referring to Mr. Whitmore's suggestion on page 212 of your September number regarding my experience with bituminous filler, I will say that Mr. Whitmore has misunderstood my meaning.

We have had the same troubles that he has experienced with "ridges" due to exactly the same causes which he has assigned. They are indeed troublesome, too. But in this instance outlined in the "Bituminous Filler Story" we were very careful and the asphalt was very hot when it was poured on account of the narrow joints to be filled. Consequently, there has been no tendency to buckle or swell so far as the pavement is concerned. And the word ridge was used by me simply to give a description to the condition existing. The pavement on either side of the expansion joints has actually worn down just as if it were ground off.

If Mr. Whitmore will go with us to Erie next month to the annual meeting of the American Society of Municipal Improvements, I will try to get a section of this pavement taken up and exhibited at the convention.

E. A. KINGSLEY,
Supt. of Public Works,
Little Rock, Ark.

Concrete Pavement in Delphi.

Among the features of the September issue of the Universal Portland Cement Company's bulletin is a description of a concrete pavement in Delphi, Ind. The method of laying the pavement is herewith described in brief:

After the sub-grade had been rolled it was covered with crushed limestone which was rolled to a thickness of four inches. A ten-ton steam roller was used. Next a concrete base five inches thick was placed. This was composed of one part cement to seven parts of gravel, and the surface was left rough. Then a one-inch wearing surface of one part cement and two parts sharp sand was put on, floated with a cork float and then trowelled. After it had been trowelled it was gone over with a brush in order to roughen the surface.

To provide an expansion joint, 1 in. by 6 in. boards beveled to ¼ inch on one edge were placed every forty feet. These boards extended through the gutters. After the top had been put on, this board was pulled out and when the concrete had set the joint was filled with a tar filler which deadened the noise and kept the water from getting under the pavement.

This pavement was laid on Main street, the business street of the town, and three weeks after it was completed it was in use. In one section the experiment was tried of corrugating the surface but it was found that this was a mistake as the edges chipped off and it was found not to be as satisfactory as the method of troweling and brushing the surface.

Other matters of interest to cement users are given in this bulletin.

Concrete Covered Gutter.

To the Editor of MUNICIPAL ENGINEERING:

Sir: I have built a gutter trunk of cement and the cost is 5 per cent. less than three in yellow pine plank, and less than half the cost of brick. Reinforced top is in sections 5 feet long. The objection the Council has is the weight of the top slab, which weighs about 700 lbs. They think it will take a half dozen men to lift them. I told them I could lift it alone, without any assistance. I have a tripod lift with windlass.

W. B., Hammonton, N. J.

The sketch shows a rectangular gutter 12 by 18 inches, with 5-inch sides and bottom and a top slab 28 inches wide, 6 inches thick over the gutter, and slightly thinner over the side walls, so that the top slab cannot be slid off of the side walls without lifting it. The design is apparently good in case a gutter must be covered and the cover lie flush with the surface. If the weight of slab is considered excessive, it can be reduced by reducing the length to 4 feet, preferably; or even to 3 feet. Also, if reinforcement is well placed, the slabs are well made, and the traffic is not of two great weight or does not come on with great shock, the thickness of the slab may be reduced to 5½ or even to 5 inches. The present designs is safer, of course.

For Macadam Test Road.

Of practical interest to good roads advocates is the 1,000 or more feet of government model road, on the Rutledge pike, near the main entrance to the Appalachian exposition grounds in Knoxville, Tennesee. It was built as a part of the government's exhibit and is the type recommended as the perfect road for East Tennessee and the surrounding territory.

The treated macadam road or tar macadam is constructed up to the top surface, as an ordinary macadam road with this difference; a road bed, to the depth of 6 inches, with dirt shoulders on each side is excavated and the surface firmly rolled and prepared for the succeeding coats or surface.

The next process in its construction was the placing of No. 1 stone to a depth of four inches; second course, No. 2 stones 2 inches. The third course and fourth stage in the construction of the road is the application of an asphalt-tar mixture, followed by a light coat of screenings, which, with rolling completes the road.

The liquid mixture on the Exposition model of the Government is composed of one-third Tarvia X, donated by the Barrett Manufacturing Company, refined tar from Atlanta, Ga., and road bed oil of the Standard Oil Company. The remaining material was obtained in Knoxville at comparatively small expense.

The road, when completed, represented a comparative outlay of $10,000 per mile, constructed by the contracting firm of J. B. McTye & Sons, under the supervision of M. O. Eldridge, highway engineer of the United States office of public roads.

A Concrete Mausoleum System.

A great deal of agitation has been noted of late relative to the pollution of streams by city sewage and garbage disposal and by the refuse of riparian owners. In many cases legislation has been adopted regulating this source of menace and providing penalties for the pollution of streams which are used for public water supply. But in few, if in any instances, have there been any steps taken to guard against the poisoning of streams and springs by the drainage from burying grounds or cemeteries.

Most people are fundamentally opposed to the cremation of the dead, which, up to late years, has been apparently the only remedy for this evil. Consequently though there has been much discussion in medical and scientific papers, the old custom of inhumation is at present the most common means of disposal of dead bodies.

Much has been written and said among sanitariums concerning the transmission of diseases through drinking water, and it is now a commonly accepted fact that the bacilli of typhoid and kindred diseases may live and thrive and be transmitted through the agency of the drinking water. Hence there have been rules regarding garbage and sewerage disposal; rules against expectorating in public places; rules regarding quarantine, disinfection, etc.; but seldom has much thought been given to earth burial, the cold storage of disease.

True, there have been some who have provided vaults or receptacles for the dead; but this means has been more the exception than the custom. It has finally become necessary, in this age of advanced theories on health and sanitation, to go back to ancient customs and adopt the catacombs system to our advancement in methods of cleanliness. This system, which has been patented, bids fair to receive a great deal of attention from the cities of the future, for it provides a means of safely disposing of the dead with no consequent danger to the living.

The system has something of the catacomb idea, but in the manner of construction and the provisions for sanitation it is unique. The mausoleum system, as it is called, permits of the assembling of a number of individual crypts, ranging in number from one hundred to ten thousand. These crypts are so designed as to be entirely dry and sanitary at all times. The common forms of construction advocated are of reinforced concrete with marble finishings throughout, and with ample lighting facilities, consisting usually of skylights.

Kankakee, Illinois, has just completed one of these mausoleums which is representative in its manner of construction.

The walls throughout are of 4-inch reinforced concrete, faced with concrete block on the outside and, where exposed, with white marble on the interior. It is 125 feet by 54 feet in dimensions and has a capacity of 544 bodies. The interior is finished in white marble and is lighted by skylights covering almost the entire roof area. A dome forms the covering of a small open chapel. A rest room occupies one corner off from this space.

The crypts are arranged in tiers five high along the side on the exterior walls and six high in a center section, so planned as to give a broad passageway entirely around the interior. Each individual crypt, when the body is placed therein and the marble slab is hermetically sealed, is air-tight. In the back of each crypt and opening into a ventilation pipe is a valve which is simple in construction and of durable material. This valve opens on a pressure of six ounces and connects with an air-tight pipe running back of each row of crypts. This in turn connects with another pipe which leads to a disinfecting plant within the structure, and in a separate part thereof, and, the gases pass through a solution of formaldehyde and a cotton cushion, thence into a vent pipe which discharges at the top of the building. Thus, any gases, coming from any crypt, passing

through this disinfecting plant are made absolutely harmless. This process of ventilation and disinfecting is patented. In addition to this ventilation each crypt in its construction slopes downward at the rear or further end from the corridor, at which end is inserted a drain pipe running into the ground underneath the structure through a bed of quick lime, thus insuring further and additional ventilation and disinfection.

An endowment plan has been adopted whereby a certain sum is set aside from the purchase price of each crypt, to provide for the upkeep of the building. This endowment fund is placed in the hands of trustees whose duty it is to provide for the maintenance and repair of the structure, and who have power to select other trustees upon the condition of death or resignation.

It would seem, when this plan of disposing of the dead has been thoroughly tested and when the need for some such a movement becomes more plainly evident, that the cities should provide for their disposal rather than allow the matter to be taken care of by private interests. Why should not the cities build and maintain same such system instead of continuing to supply that institution that is so prejudicial to public health, the graveyard? It would seem that some of the care and attention devoted to maintaining drives, planting vegetation, etc., to beautifying our cemeteries, might be better bestowed upon providing a safer, more sanitary and less objectionable method of burial.

An Expansion Joint Form.

The National Construction Company, of Fond du Lac, makes use of a patented steel form for providing expansion joints in pavements. This form, which is now being used on cement street work, could easily be adapted to other forms of paving requiring a concrete base.

It consists of a metal strip about four feet in length and bent flat on itself so as to form a V-shaped cross section, tapering from an edge to about half an inch between the edges at the top. These top edges are bent over to offer a means of lifting the form. The form is about 6 inches in height and is used in conjunction with form boards. Its value lies in the fact that, owing to its tapering section, it may be easily withdrawn, permitting the removal of the form boards without injury.

A Sewer Outlet on Steep Grade in Louisville, Ky.

Among the peculiar tasks involved in the construction of the new sewerage system of Louisville, Ky., has been that of providing a new outlet structure into the Ohio River for an old circular brick sewer 11 feet 6 inches in diameter, at Thirty-fourth street. In the case of two other outlets into the river, the chief engineer, J. B. F. Breed, and Harrison P. Eddy, of Boston, the consulting engineer, devised structures for making the descent of a steep, shifting bank that is quite out of the common range of sewer construction. In the case of the Thirty-fourth street outlet, the grade to the river, 8.73 per cent, was must less steep than that of the outlet of the "southern outfall," but the problem has some other features of compensating interest. The details of the situation also throw some light on an earlier and different sort of engineering practice from that of the new system.

In connection with the various investigations which have been made of the old sewer systems, it had been found that the outlet of the Thirty-fourth street sewer, construction of which was completed in 1890, was in very dangerous condition. This outlet structure is 450 feet in length and consists of a boiler-iron tube placed in cast-iron cradles resting upon a pile foundation. The heavy load on this tube caused serious deformation and it was early found necessary to support it by means of wooden struts or props placed vertically in the center of the tube. In hopes of remedying this condition a part of this tube, where the load upon it is very heavy, was at a later date reinforced with brick masonry, carried from footings placed at an elevation about equal to that of the bottom of the tube, up and over the sewer. After making studies of different methods of reconstructing this outlet, it was decided to build an entirely new structure in a new location slightly west of the old sewer to a point a little over 100 feet further into the river than the old head-wall.

The new construction is 592 feet long, of which 506 feet is of horseshoe-shaped section with circular arch; the outlet structure proper, with the apron, is 86 feet long. The whole is of reinforced concrete, with plain, round steel bars. The outlet consists of a sewer 7 feet wide by 6 feet 8 inches high, of reinforced concrete and lined with vitrified brick to the springing line of the arch. For nearly its whole length it will be upon a very steep grade, at the foot of which there is a short outlet structure. That portion upon the steep grade was designed to rest upon reinforced concrete piles, but after the trench was opened at the upper end the soil was found to be sufficient in itself to stand the load coming upon it, and, therefore, the use of piles was omitted for a distance of 180 feet. The outlet structure was carried down to bed rock, and for a distance of 20 feet out a cut 4 feet in depth was made into this rock, and the masonry of the structure carried into it in order to give the sewer a good footing.

The reinforced concrete piles required were driven with a casing and cast-iron point. The first piles driven were at the foot of the steep grade in the sewer,

about seven feet in length. At this point there was a considerable flow of water from above, which interfered to some considerable extent with the driving of the piles. After the casing had been driven, any water within it was removed by means of a steam siphon, having a hose steam supply pipe and hose discharge. This was lowered to the bottom of the casing, the water removed, the reinforcement put in place and concrete immediately deposited. As the casing was lifted the concrete was rammed, thous forcing it into the hole and against the ground. The reinforcement of these piles consisted of four ¾-inch steel bars. The piles driven and to be driven vary in length from 7 feet to about 24 feet, and will rest upon bed rock, where it is within 20 to 24 feet from the masonry of the sewer.

The sewer has been built in three operations, the invert and side walls being first placed, then the brick lining laid, and finally the arch constructed. The outer portion of the outlet structure was flattened and widened in order that the sewer might not project anywhere above the surface of the wharf and interfere with navigation.

Water Supplies Using Compressed Air.

With reference to inquiry from "C. M. T" in your September issue, re compressed air water supplies, in the *Canadian Engineer* of April 15, 1910, is an article by F. T. McArthur, engineer at Yorkton, Man., descriptive of a plant which is in successful operation in that town. I believe this plant was dealt with further in subsequent issues. No doubt Mr. McArthur can give details.

R. D. WILLSON,
Asst. City Engineer, Winnipeg, Man.

MUNICIPAL MATTERS IN COURT

Higher Courts—Omaha Water—Compliance with Specifications.

Decisions of the Higher Courts of Interest to Municipalities.

Duty and Liability of Municipality.—As a general rule, a department of a city government, in discharging a duty primarily resting upon the city, acts as the agent of the city, although the department may have full power and authority in the particular matter, but it rests with the Legislature to determine the extent and manner in which the city shall be subject to liability for the acts of the department. An action for injuries received by reason of a defective sidewalk in the village can not be maintained against the village, but must be brought against the commissioners.—Scott v. Village of Saratoga Springs (N. Y.), 92 N. E. 323.

Contracts—Suits by Taxpayers.—Where a taxpayer, who sues to set aside a contract for the construction of a public library, under Laws 1898, c. 115, as amended, providing for the improvement of public highways, does not show fraud or corruption in the making of the contract, or the proceedings prior thereto, he must, to succeed, show that the contract is the result of illegal official acts, and it is not sufficient that the contract is unwise or extravagant.—Dunning v. Elmore & Hamilton Contracting Co. et al. (N. Y.), 124 N. Y. S. 107.

Plans—Modifications—Validity. — The original plan of the state engineer for a highway contemplated a road encircling the face of a mountain, leaving the river side of the road open so as to afford the advantages of a river view. It also involved the construction of three tunnels, 500, 105, and 65 feet long, and a steel bridge across a gully. The plan was approved by the county board of supervisors. The engineer changed the plan so as to require the road to pass through the mountain 320 feet distant from the original line, leaving the river front for a considerable part of the distance, and providing for a tunnel 1,265 feet long with no side openings, and a rock fill in place of the steel bridge. The altered plan did not provide for ventilation of the tunnel or police protection, both of which were necessary. *Held* that, though the state engineer could make changes in details in the plan, the changes made were unauthorized unless approved by the county board of supervisors, though the road provided by the new plan was shorter, and though it was not feasible to construct the road as originally planned, and though the cost of the construction of the road under the altered plan would be less than under the original plan, especially as it was claimed that the cost of acquiring the

necessary land would be greater.—Dunning v. Elmore & Hamilton C. Co. et al. (N. Y.), 124 N. Y. S. 107.

Liability of Municipality for Small Sewer.—In an action against a city for failing to construct a sewer of sufficient size to carry off surface water, thereby causing an overflow of the land of an individual, the recommendation of a city officer for the construction of a sewer, embodied in a report made to the city, was inadmissible; the city not being bound by recommendations for improvements by its different officers. A city, in constructing sewers to provide for surface waters, need not construct them so as to provide against all floods, but it must at least guard against the effect of rains which occur with frequency, if that can be reasonably done.—Kurrle v. Mayor, et al., of Baltimore (Md.), 77 A. 373.

Surface Waters—Liability.—Private persons graded and paved a private street and thereby turned the water on a public street in such quantities as to overflow the property of an individual. It was not shown that the city had accepted the private street. *Held,* that the city was not liable merely because it did not grade, pave, and place gutters in the public street, though the parties in grading and paving the private street removed a barrier which had protected the property of the individual.—Kurrie vs. Mayor, et al., of Baltimore (Md.), 77 A. 374.

Services Rendered in Violation of Civil Service Law.—A municipal corporation is not liable for the reasonable value of services rendered by employes of a department appointed in violation of the civil service provisions of the charter of the municipality.—Shaw v. City and County of San Francisco (Cal.), 110 P. 149.

Injuries from Defective Sidewalk—Claims—Necessity for Verification.—Under Medina Charter requiring a verified statement of claim against a village for injury caused by the defective condition of a street or other public way to be presented before suing, verification is essential to a valid claim, though the village be not prejudiced by no verification. Under such charter and laws a retention by the trustees of an unverified statement is no waiver of verification. Under Medina Charter requiring a statement of claim against the village for injury caused by a defective street or other public way be presented to the trustees within six months, and making failure to do so a bar to suit, the claim must be presented before a right of action accrues.—Cortiss v. Village of Medina, 124 N. Y. S. 510.

Streets—Title—Acceptance by User.—Where land was known as Rose Alley and used as an alley as early as 1862 and so continued until the issuance of a patent by the United States thereto in 1868 to the chairman of the town board of trustees, in trust for the occupants, the trust for which the town trustees took the title was to maintain it as an alley. In ascertaining whether or not a highway, park, or public place has been accepted by user, the purpose which the way, park, or place is fitted or intended to serve, must be the standard by which to determine the extent and character of use necessary to constitute an acceptance. Any user by adjoining owners of a public alley for the purposes of an alley cannot be presumed adverse to the public's right.—Koshland v. Cherry (Cal.), 110 P. 143.

Liability for Negligence of Highways.—The construction and repair of highways by a city is a ministerial rather than a governmental function, so that the city is liable for negligence therein.—Engleking v. City of Spokane (Wash.), 110 P. 26.

Defective Sewers—Failure to Remove Defect.—When a public sewer becomes clogged, and private property thereby becomes flooded, it is the duty of the municipality, when notified of the situation, to take the necessary steps to remove the clog with reasonable promptness; and for the breach of such a duty an action will lie.—Murphy v. Mayor and Council of Borough of Atlantic Highlands (N. J.), 76 A. 1073.

Improvements — Shade Trees. — The rights of the city in making authorized public improvements in the streets with proper care and skill are paramount to the interest of an abutting owner in trees planted in the streets, even though such abutter owns the fee of the street, and although the trees may be injured, and such injury might be avoided by the adoption of a different plan. The court cannot interfere with the discretionary powers of municipal authorities, and direct them to save shade trees about to be destroyed by improvements.—St. Mary of the Angels' Church vs. Barrows et al. (N. Y.), 124 N. Y. S. 571.

Excavations in Streets—Liability of City.—In an action against a city for personal injuries resulting from plaintiff's falling into an excavation made in a street, although the act of incorporation of the city may have given to the city trustees exclusive power to regulate its streets, drains, etc., yet where it appeared that for some years the city had paid the bills which were approved by the city trustees for street work done by the city marshal and had permitted him to do such work, it must be presumed that it authorized him to make the excavation in question rendering the city liable for his negligence.—Barnes v. City of Carson (Nev.), 110 P. 3.

Contracts—Competitive Bidding—Common Standard.—The board of chosen free holders under the provisions of the act of March 28, 1892 (P. L. p. 308), invited bids for the construction of a bridge according to a certain proposal, plans, and specifications that were advertised and duly exhibited to prospective bidders who were, by the proposal, required to bid "a lump sum for the whole work complete."

The proposal reserved to the board the right to require more or less work to be done under the contract, and therefore called upon each bidder to state the unit price he would charge in case of the increase or decrease in the quantity of material required. *Held,* that the competitive feature of the proposal was the bidding that was invited for the entire work as specified, and that the contract must be awarded upon the basis of such bidding and not upon estimates compiled by the engineer of the board by applying the unit prices to "a work" that differed radically from that specified in the proposal. Where there is no common standard there is no competition, and the same is true where the common standard to which a competition is invited is abandoned in declaring its results.—Browning et al. v. Board of Chosen Freeholders of Bergen County et al. (N. J.), 76 A 1054.

Waterworks Company — Contract to Furnish Water—Rates.—Under the franchise of the Birmingham Waterworks Company, it was entitled to contract with an individual to furnish water for less than the maximum franchise rate and less than the rate charged other individuals for similar service, so long as the discrimination is enjoyed solely at the expense of the company, and does not infringe on the rights of the other consumers. Where a waterworks company contracted to furnish plaintiff with water at less than maximum rates, the contract was subject to the implied provision that the charge for water should in no case be greater than the maximum franchise rate nor greater than a reasonable charge.—Brown v. Birmingham Waterworks Co. (Ala.), 52 S. 915.

Public Improvements—Formation of Districts—Enforcement of Assessment.—The creation of a district for the construction of waterworks and a district for supplying the city with electric lights is authorized, and, as the statutes do not specially prohibit the creation of one district to make both such improvements, one district may be created for the purpose of constructing waterworks and supplying the people with electric lights, unless one district, when so created, cannot be used to make both improvements. Where the complaint, in proceedings to enforce an assessment, substantially complies with the statutory requirements, and defendants do not attack the improvement district except to say that it embraces two entirely distinct improvements, the presumption is that the district was created in a lawful manner and is legal.—Wilson et al. v. Blanks et al. (Ark.), 130 S. W. 517

Public Improvements—Competitive Bids —Where an ordinance authorizing paving required that it should consist of a certain variety of asphalt which was an article of common merchandise, and of no greater price than other kinds of asphalt, and was not held in monopoly, the provision, was not void as violative of the charter provision requiring contracts to be let to the lowest and best bidder.—Cleveland Trinidad Paving Co. v. Lord et al. (Mo.), 130 S. W. 371.

Contracts — Competition. — Where the New York City board of estimate and appointment, in awarding contracts for public work, imposes only such conditions as allow a fair and reasonable opportunity for competition, the courts cannot interfere. Where, because of the steep grade of a road, it was determined to pave a portion thereof with bitulithic pavement or asphalt blocks designedly omitting smooth pavements, an advertisement for bids on such pavements presented a fair and reasonable opportunity for competition.—Hastings Pavement Co. v. Cromwell, Borough President (N. Y.), 124 N. Y. S. 388.

Ordinances—Validity—Sewer Improvement Districts—Assessments.—An ordinance creating a district to construct and establish sewers is not invalidated by a severable provision creating a district to manage and operate a sewer district. A sewer improvement assessment is not invalid because provision is made for issuing bonds, the principal of which is less, but the aggregate amount of principal and interest of which is more, than the amount fixed by the petitioners for the improvement as its cost. The assessment, however, cannot go beyond the limit imposed by the statute; in this case 20 per cent of the value of real estate as shown by the last county assessments.—Webster et al. v. Ferguson et al. (Ark.), 130 S. W. 513.

Compensation—Injury to Property—Alteration of Grade of Street by City.—The city council of Minneapolis has, under the charter of that city, the authority to establish street grades, but in making the improvement cannot take, destroy, or damage private property without compensation. The grading of a street by the street commissioner under the direction of the engineering department, pursuant to a resolution of the city council ordering the construction of sidewalks upon a grade to be "given by the city engineer" and paid for with municipal funds, is the act of the municipality.—Hallenberg v. City of Minneapolis et al. (Minn.), 127 N. W. A. 422.

Public Improvements—Liability of Officers.—The public officers who perform the physical acts required to make a public improvement, which, though irregularly made, is performed pursuant to the direction of the municipality, and is one which it is within the authority of the municipality to order, are not trespassers or personal wrongdoers.—Wallenberg v. City of Minneapolis et al. (Minn.), 127 N. W. 422.

Public Improvements — Estimate of Amount of Work Done—Authority of Of-

ficers.—A city appointed a city engineer charged with the duty of superintending the construction of sewers. Subsequently it contracted for the construction of a sewer and provided that the engineer should superintend the work in its details, and should measure the rock encountered in excavating the trenches. *Held,* that the city engineer or other officer shall have charge of the construction of sewers, etc., the official estimate by the engineer of the amount of rock excavated in constructing the sewer was a prerequisite to the validity of tax bills issued for the cost of the work, and though the engineer was not required to perform the mere clerical labor necessary to actual measurement of the rock formation, he must take the sewer construction under his personal control and apply his professional skill in securing proper measurement of the rock excavated, and that duty he could not delegate to an inspector acting as his agent during his temporary absence from the work.—Ernst et al. v. City of Springfield et al. (Mo.), 130 S. W. 419.

Cancellation of Instruments—Grounds of Relief.—Where county warrants are issued for the cost of building a bridge, the contractors guaranteeing to build it in a workmanlike manner, where the bridge collapse a year after its building on account of unworkmanlike manner of its construction, the county may maintain a suit in equity to cancel the warrants and recover the money paid on the contract. —Converse Bridge Co. et al. v. Geneva County (Ala.), 53 S. 196.

Board of Public Works—Right to Hold Office—Validity of Statute.—It is not unconstitutional for the Legislature to provide for a board of public works, composed of four persons, not more than two of whom shall be members of the same political party. The act creating a board of public works in cities having a population of not less than 100,000 nor more than 200,000 inhabitants (P. L. 1907, p. 114) is not a "private, local, or special law" affecting the internal affairs of towns or counties, within the constitutional prohibition.—Wilson, Atty. Gen., v. McKelvey et al. (N. J.), 77 A. 94.

Authority of Water Board—Charges for water Furnished City.—The charter of the city of Olean, created a city water board and a park board, and gave the water board power to establish a water system, to borrow money and issue bonds therefor to aid in the construction of the water system, to establish a scale of water rents, and provided that if the entire annual receipts for water rents, after paying expenses, should in any year be insufficient to pay the interest for that year on the loan, or insufficient, with the amount in the sinking fund, to pay any part of the principal falling due that year, the common council should cause such deficiency to be assessed and collected as other expenses of the city. The water board was further empowered to establish by-laws, rules, and regulations for the collection of the water rents and the manner of using water, and to enforce the observance thereof by cutting off the use and supply of water. The water board provided by rule that, if water rents were not paid as therein required, the supply of water should be shut off. On the refusal of the park board to pay the rate which they established for use of water by that board, the water board shut off its supply. *Held,* that, in the absence of an express provision in the charter requiring the city or any of its departments to pay water rents, the water board was without authority to charge the city or any deparment for water used. If the water board had been authorized to charge the park board for water furnished it, the remedy for failure to pay for the same would not be by turning off the water, as the supply to the park board was to meet a public necessity, and should not be interfered with.—People ex rel. Johnson et al. v. Barrows et al. (N. Y.), 124 N. Y. S. 270.

Public Improvements—Materials—Lien for Labor.—Under Lien Law, giving a lien for the value or agreed price of labor performed or materials furnished for the construction of a public improvement, a lien may not be acquired for the use or rental of a steam shovel for use on the work, where the person claiming the lien did not perform any labor in connection with such use, though the implement was hired by the contractor specially for use on the work.—Troy Public Works Co. v. City of Yonkers et al.; Warren v. Same (N. Y.), 124 N. Y. S. 307.

Decree in Omaha Water Case.

As a resu't of the hearing on a proposed decree which the city sought to have signed against the Omaha Water Company in the waterworks case, argued in United States Circuit Court, the city of Omaha, when it takes over the plant will be compelled to pay interest upon the appraised value of the plant from August 9, 1906, an amount totalling almost $2,000,000, and in return will receive the net profits of the plant from that date until the time it is taken over.

Early in the hearing the attorney for the water company offered a decree which he proposed to substitute for the one asked by the city. This in substance, would order the water company to turn over to the city all the profits which the plant has netted it since the deed was offered the city in 1903; would order the property near Krug park, on Burt street and near the settling basin in Florence, to the title to which there is objection on the part of the city, be exempted from the purchase and a corresponding reduction in the appraised price

made, and would compel the city to pay the appraised price with interest at the legal rate from the date on which the water company claims to have offered it a sufficient deed to the property. This was objected to upon the ground that the company had no right to exempt the city from the purchase of the property in question, contending that that matter was one for the city itself to settle. The decree which the city had asked to be granted and which provided among other things for the submitting by two New York trust companies of the mortgages held against the water company by them, was objected to on the ground that the court had no jurisdiction over these companies and hence it would be impossible to enforce such a decree. The judge also gave it as his opinion that it was the duty of the court to see that the trustees of the mortgages upon the plant discharge them. He ordered an accounting of certain materials included in the company's plant and for that purpose appointed a special master in chancery.

Railway Company Must Comply with Paving Specifications.

In a sweeping decision which completely wipes out all quibbling by the Springfield Railway Company in the matter of making desired improvements in the manner of paving streets in Springfield, Ohio, Judge Albert H. Kunkle held in his opinion in the street railway paving case that the city had the legal right under the company's franchise to demand any reasonable construction as a base for the tracks when paving South Yellow Springs street.

The decision reflects a complete victory for the city in the much-debated question as to whether the officials could compel the railway company to lay a base of six inches of concrete beneath its ties instead of gravel as has been the company's custom.

Judge Kunkle held that while the new specifications employed by the company since January 1, explicitly contain this provision, the same proposition is also covered in the former specifications that cover the South Yellow Springs street paving contract. Provisions for a subbase of 6 inches beneath all of the pavement appear in the specifications. The court held that this did not mean a portion of the pavement, but beneath the entire structure, regardless of any ties that may be installed by a railway company.

The company will take no further steps to stop the progress of the work. Providing a satisfactory entry can be drawn up which will reserve the right for the railway company to contest the payment of the expense connected with laying the extra concrete between the ties. Between the ties, if the city's plan is followed, there will be 12 inches of concrete and this imposes an extra burden of expense upon the railway company about which there will be some question as to whether the company or the city is liable for the payment.

CURRENT INFORMATION

Education by Street Railroad—City-Owned Car Line—Coal Dust Explosions—Municipal Land—Washington Parks—Public Service Commission—Fuel Specifications—Concrete Coast Defenses—Edison Houses.

Public Education by a Utility Corporation.

The Southern Wisconsin Railway Company, of Madison, Wis., believes in talking its troubles over with that often neglected factor in municipal railroading, the public. For this purpose the company expends each month a certain amount to set its ideas before the people through the medium of printer's ink, in the following manner.

For one week of each month a half page is reserved in each of the papers of the city of Madison for use by the company. Then the material so used is printed in the form of hand bills which are tied in bundles at either end of each of the cars operated by the company. The subject matter of these articles is of a widely divergent scope, but, of course, pertaining always to the management, use, problems and troubles of the company. Articles by prominent men in electric railway lines, court decisions, comment from magazines of note and such matter forms the bulk of the material used. The company puts the proposition in this light:

We believe in advertising and we think the papers are second only to the street cars for that purpose—we carry from 8,000 to 12,000 people each day with as little friction and as few accidents per passenger as can be found in any similar city in the United States. We

have a firm conviction that the people are entitled to know both sides of every question, which, as final arbiters they are called upon to settle—in order that we may get at all of the people through the two best mediums we shall use both the newspapers and the cars, and through these mediums we shall present such matters as are of interest to you and concerning which you should be well informed.

But perhaps there are some who will still contend that the procedure is only due to a desire to secure more lenient legislation, rather than a desire to enlighten the public in what it should know.

City-Owned Car Line Pays.

Municipal ownership and operation of a street car system has proved remarkably successful in Belfast, according to Consul Henry B. Miller. To students of municipal ownership problems there is special interest in this subject.

Low cost of transportation, economy of administration and lack of accidents are points chiefly emphasized by Consul Miller, explaining the success with which Belfast has run its own street cars. The regular fare there is 2 cents. One of the unusual features of the system is the concentration of all lines through a general central station which makes every part of the city accessible from that center.

Belfast took over the street car system of the city about five years ago. Its head is a general manager selected by the city council.

The Explosibility of Coal Dust.

The recently created Federal Bureau of Mines has just issued a bulletin on the explosibility of coal dust, with chapters by J. C. W. Frazer, Axel Larsen, Frank Haas and Carl Scholz. The bulletin was prepared by the Technologic branch of the United States Geological Survey, which is now a part of the Bureau of Mines, and therefore will be known as Geological Survey Bulletin 425, but will be distributed by the Bureau of Mines. The author of the bulletin, George S. Rice, chief mining engineer of the bureau, goes fully into one of the most serious and most perplexing problems that the coal mines have had to contend with in the last few years. He traces the growth in the belief in the explosibility of coal dust, summarizes the experiments and mine investigations that have established this belief and gives the present status of preventive measures.

In the introduction, Mr. Rice says: "Only within comparatively few years has the dry dust of bituminous and lignitic coal been generally recognized as an explosive agent more insidious, threatening and deadly to the miner than firedamp. Firedamp carries its own flag of warning, the 'cap' in the safety lamp, but coal dust, though visible, does not attract attention until present in large quantities."

Mr. Rice reviews the experiments into the explosibility of coal dust in foreign countries and dwells at considerable length upon the attitude taken in France by the engineers, who, until the great disaster at Courrieres in 1906, which cost 1,000 lives, did not believe that coal dust would explode without the presence of firedamp. Mr. Rice concludes by reviewing the various remedies that are offered for the coal dust problem, giving the good and bad points of each.

This bulletin may be obtained by addressing the director of the Bureau of Mines, Washington, D. C.

Municipal Ownership of Land Profitable.

In a report offered as chairman of the committee on parks, playgrounds and school of New York City, Alderman Campbell offers figures to show that municipally owned land is very profitable.

Nearly all land bought by the city before 1850 has increased unbelievably in assessed valuation, admittedly below the market price, over the original cost. One case of nearly 9,500 per cent, increase within the last sixty years was found, several cases of from two to five thousand per cent. increase in the last seventy-five years, ninety-five cases of over 500 per cent increase, and nearly three hundred of over 100 per cent. The city owns in all 943 sites.

Alderman Campbell notes that Berlin owns one-tenth of the land within its own limits. Vienna about one-seventh, Munich one-fourth and Frankfort-on-Main about one-half.

Action Urged in Washington Park Plan.

Urging that the commissioners send Congress proposed legislation for the construction of a park system within the District of Columbia, M. C. Hazen, District surveyor, gives warning that unless something is done quickly many sub-divisions will be made and improvements placed thereon so that the ideas in certain features of the great proposed park system will be entirely frustrated. The warning is embodied in a report of the year's work of the surveyor's office sent to the commissioners August 31.

During the last session of Congress authority was given under public act No. 170, approved May 10, 1910, authorizing the commissioners to condemn and acquire fee simple and absolute title, including all riparian rights, to a strip of land for public highway and for park purposes along the Anacostia river from Monroe street to Giesboro point.

Mr. Hugh T. Taggart, special counsel on the ownership and riparian rights along the Anacostia river, in his report to the commissioners holds that the

United States owns to the high-water line along the shore of the Anacostia river. It is therefore very important that these lines be accurately determined by an official survey.

This high-water line is receding rapidly. Where it was once water it is now left dry, and should, under Mr. Taggart's opinion, belong to the United States, but as filling and accretion is going on along the bank of this stream very rapidly, thereby shifting the water line and obliterating the original shore line, it allows owners of adjacent property to include new areas in their holdings.

Maryland's Public Service Commission.

After a great deal of controversy and newspaper agitation, the state of Maryland has adopted an act providing for a public service commission similar to those of other states, notably Wisconsin. The commission created under this act is vested with supervision of every class of public service corporation in Maryland. In defining "common carrier" the following classification is given:

All railroad corporations, street railroad corporations, express companies, car companies, sleeping car companies, freight companies, freight line companies, steamboat, power boat, and vessel boat, and ferry companies, canal companies, and all persons and associations of persons, whether incorporated or not, operating such agencies for public use in the conveyance of persons or property with this state, by land or by water, or both.

In a similar specific manner gas corporations, electrical corporations, telephone, telegraph, water, heating, and refrigerating companies are defined and brought under direct jurisdiction of the commission.

The field of control of the commission is so broad in fact that it seems as though it were intended to give jurisdiction over all matters pertaining to character of service, rates charged, capitalization of companies of all sorts and conditions of public service corporations, or associations, or individuals which in any capacity supply the services indicated. In addition, franchise grants to new companies are made subject to the approval of the commission.

The commission consists of three members appointed by the Governor, one of whom is named as chairman at the time of his appointment. The only qualification for office is that the appointees shall be legal voters over 25 years of age and shall not hold any official relation to any corporation or company coming under the jurisdiction of the commission; nor shall they hold any stock nor have any interest in any manner in the corporations specified. The commissioners hold office for 6 years, a new one being appointed at the end of each two years. The salaries are $6,000 for the chairman and $5,000 for each of the other members respectively, half of the chairman's salary and two-fifths of that paid to each of the other commissioners is to be paid by the City of Baltimore; but no provision is made for specific services to be rendered to the City of Baltimore different from those given to any other city of the state.

Provision is made for investigation by the commission of "the cause of all accidents on any railroad or street railroad resulting in loss of life or injury to persons or property, and which in its judgment shall require investigation." All railroads and street railroads are required to notify the commission of every accident occurring on their lines. Provision is made for a uniform system of railroad and street railroad accounting, conforming as nearly as may be to those of the Interstate Commerce Commission.

Full authority is given the commission to investigate the quality of service rendered by any corporation, and in case of need to prescribe such changes on modifications as may be necessary. Full power is given to set standards, designate tests, and to require the fulfillment of such provisions.

The commission is also given "full and plenary power to value the plant, property, appurtenances, assets and franchises" of corporations under its control and to "prescribe uniform methods of keeping accounts" and records of all such companies. Complaints regarding the quality and price of gas and electricity may be made to the commission by municipal authorities, or by 100 customers, whereupon the commission must make an investigation and finding and issue orders accordingly.

Two peculiar features of the Act creating the commission have caused some comment. The first is that providing that the offices of the commission shall be open from 8 a. m. to 9 p. m. every day in the year, with one or more responsible persons in charge. The other fact that is occasioning comment is that no provision is made for retaining an engineer, though clerks and others are provided for; in most cases they are chosen by the commission subject to the approval of the Governor.

Protest Against New York's Fuel Specifications.

The Black Diamond, the official organ of the coal industry, has addressed an open letter to Mayor Gaynor, protesting against the recently adopted specifications for coal to be furnished to the City of New York.

The first provision to which exception is taken is that providing that all coal shall be purchased on the B. t. u. basis. New York uses principally anthracite coal, and purchases this through retailers. The producing companies resist the sale of coal on the B. t. u. basis, so that the provision objected to imposes a condition on the middleman, which he in turn cannot transmit to the wholesale dealer.

The paragraph providing for a check analysis does not give to the contractor the right of having a representative present when the city makes such an analysis, and, in fact, gives no assurance as to the competency of the persons making the tests.

Exception is taken to the requirement that all coal wagons shall be sealed so as to prevent loss or abstraction of coal after the wagons have been weighed. This objection is made on the ground of extra labor and expense in sealing the 500,000 tons of coal delivered to New York City annually.

The greatest objection voiced in this protest is with regard to "Corrections of Gross Tonnage," which provides corrections as follows:

For the percentage of moisture in excess of the allowed limit, proportionate deduction.

One per cent. for each per cent. of ash in excess of a standard analysis.

One per cent. for each one hundred B. t. u. below standard heating value.

Five per cent. for each one per cent. of volatile sulphur in excess of a standard analysis.

Two per cent. for each one per cent. of volatile combustible matter present.

Payment will be made only on the net tonnage after these deductions have been made.

The Black Diamond protests that in paying for heat units on the B. t. u. basis there is nothing paid for foreign matter. In deducting for impurities a double penalty is enforced in that the contractor has to stand for the increase in impurities and the consequent decrease of heat units. The clause relating to the ash is objected to, but it is stated that such a clause is customary, though unjust.

Further objection is made to the statement providing that "excessive clinker or prohibitive amount of smoke shall be cause for the condemnation of deliveries of coal." It is stated that this provision makes the contractor responsible for conditions in the firing room, for clinkering and smoking can be avoided by proper firing.

It is stated that the intention of the specifications was to save money to the city. The opposite result is expected, for it is said that the contractors will be obliged to raise their prices to provide a margin of profit to cover their risks in meeting such rigid specifications.

Concrete Coast Defences.

Recent tests at Sandy Hook of the resisting power of reinforced concrete as a defense against high-powered projectiles confirm the calculations of the penetrating power of the twelve-inch gun. A concrete wall twenty feet thick, heavily reinforced with steel beams, was pierced by a twelve-inch projectile fired at high velocity. The blow delivered was sufficient to penetrate twenty-two inches of armor plate, and the reinforced concrete withstood the attacks so well that it will probably be used in the construction of the new coast defense fortifications in the Philippines.

The Edison Poured Cement Houses.

One feature of the Cement Products Exhibition to be held in Madison Square Garden, New York, on December 14-20, 1910, is to be an exhibition of the pouring of cement houses according to the Edison plan.

The plan upon which Mr. Edison has been working is briefly, the completion of a set of steel molds which can be used time after time in pouring houses. It is said that the great inventor has produced a mixture of a consistency almost like water which holds the aggregate in suspension, allows the mixture to flow freely to all parts of the molds and secures a uniform distribution of the concrete throughout. The molds are capable of variations of arrangement, making possible different styles of houses from the same set of molds. With a half dozen molds, therefore, a wide diversity of styles will be possible.

Mr. Edison and his engineers claim that such a house can be built for $1,200. It is intended for one family, is to be built on lots about 40 ft. by 60 ft., and has a floor plan 25 ft. by 30 ft. There is an 8-ft. porch in front and a small rear porch. The house is not to be of plain panels, but will have considerable exterior ornamentation. The ornaments will be cast with the house and will be reinforced concrete, including the roof, floors, inside walls and stairs.

Mr. Edison proposes to erect the molds for such houses in four days. After the molds have been assembled, the time allowed for pouring the concrete is six hours. Fourteen days after the pouring the house is complete. It is estimated that with six sets of molds, one hundred and forty-four houses can be built in a year, the forms being used indefinitely, thus reducing the cost to a minimum. A complete set of molds is to cost approximately $25,000.00.

That this idea of pouring cement houses is destined to play an important part in the industrial world is already evidenced by the action of the American Sheet and Tin Plate Co., in building two hundred workingmen's houses of concrete at Gary, Ind., using a set of steel molds which are of their own design and construction. The plan is strikingly similar to the Edison idea of pouring houses.

WATER WORKS

Houston Water Works—Water Waste—Storage Reservoirs—Somerville Water

Houston's Water Works System.

During the past year the city of Houston, Tex., has awakened to the extensive waste of water by private consumers. This waste was a very serious factor inasmuch as the source of supply is an artesian well system and not inexhaustable.

As the first step toward preventing this useless waste of water the city adopted the plan of metering the water furnished to the big consumers, and so successful did that plan prove that a general order was issued to meter all connections, including the railroads and other big concerns. The work of installing the meters is now in progress, and it is expected before the lapse of another year that the entire city will be metered.

In connection with this installation of meters an ordinance was passed by the city commissioners authorizing the sale of water meters to consumers on the monthly installment plan, the meter to become the property of the consumer as soon as a certain amount is paid to the city to cover the cost of the meter and expense of installing it. Less than 18 per cent. of the total number of water consumers were supplied through meters on March 1 of this year, and from that small percentage a saving of more than 40 per cent. in per capita pumpage was noted. Since March 1 many additional meters have been installed, with the result that the pumpage has shown a greater reduction.

During the last fiscal year of the city, which ended February 28, the total consumption was 3,197,477,010 gallons, making an average daily consumption of 8,760,211 gallons, or a total of 87.6 gallons per day to each inhabitant, based on a population of 100,000.

The water that passed through meters measured 415,672,011 gallons. The cost of supplying water per 1,000,000 gallons, figured on maintenance, was $22.33, while the total cost per 1,000,000 gallons figured on maintenance and interest was $39.45.

Since the beginning of city ownership, October 1, 1906, the per capita pumpage has been reduced from 155 gallons to 85 gallons per day, a net saving of 43 per cent., with less than 18 per cent. of the consumers supplied with meters at that time. It is believed that with the installation of additional meters the waste will be eliminated and the per capita pumpage cut down to about 60 gallons per day, which is deemed an adequate amount to supply the city for all purposes.

At a cost of $112,532.56 the city during the last fiscal year installed 4,423 feet of 24-inch, 8 feet of 20-inch, 12,418 feet of 12-inch, 76,372 feet of 8-inch and 32 feet of 6-inch mains, making a total of 93,253 feet and giving the city a system of 94.6 miles, an increase of 23 per cent. over the previous year.

The rapid growth and development of the city made it necessary for the city to extend many of its mains during the present year. These extensions were made in localities where fire protection and pure water for general supply were needed and, incidentally, where the general circulation of the system could be improved by connecting dead ends and low places.

The problem of pumping capacity was solved when the 15,000,000-gallon pump was installed last November, thereby doubling the capacity of the plant.

A new system is under consideration and the site for it has already been secured. Upon this property there is situated a large lake, which the city proposes to use as a storage basin, keeping it well supplied at all times with water from artesian wells.

Consulting Engineer F. L. Dormant has been instructed by Mayor Rice to prepare plans for the proposed new water station and for a system of new mains to be used in supplying high pressure.

Waste in Water Works Due to Fire Protection.

Depletion of the lumber supply attracts much attention. We imagine Uncle Sam discusing it earnestly, even passionately; then lighting his pipe and absently dropping the match in the wood box. The country produces five hundred million dollars' worth of lumber a year and burns up eighty million dollars' worth of frame buildings—and seventy million dollars' worth of contents, to show that it has no prejudices in the matter. The annual fire loss—largely preventable—amounts to two dollars and a half for every man, woman and child.

The huge cost of the fire protection required by the prevalence of wooden buildings, bad construction, and carelessness is strikingly suggested by the fact that there is a total of more than $150,000,000 tied up in the mere value of the metal of the fire hydrants and their supply pipes of our cities. Fire service requires water works equipment valued at

$245,671,000; and the annual expense of the fire protection portion of the public water works systems is just under $29,000,000.

Large totals, however, may be large without giving the average man any clear idea of what they mean. We are used to big totals, on all sorts of topics. Metcalf & Eddy, civil engineers of Boston, have therefore done a good service to better understanding of the fire loss by constructing a table which shows the proportion of the outlay for different parts of water works systems that is chargeable to fire protection. This table is based on the totals given in a recent bulletin of the United States Geological Survey.

Metcalf & Eddy's table shows that of all the money paid for sources of water supply, fire service is responsible for about 11 per cent. This does not seem extreme, for obviously no very large amount of water, in comparison with other uses, will be needed for putting out fires. The distributing mains and pipes of the fire system absorb 27.2 per cent. of the cost of the whole distributing system; while 28.4 per cent. of the total tons of pipe are devoted to fire service. For the whole country, fire service in the water works systems is responsible for 22 per cent. of the total outlay. The Metcalf & Eddy table shows further that the fire service is proportionately less costly in the largest cities. The percentage on all three of the items named above is below the average in cities of 100,000 inhabitants and over. It rises, generally speaking, as cities become smaller, and is furthest above the average in cities of 5,000. This suggests that small cities, which are the least insistent on fire-resisting buildings, might do well to adopt the restrictions that are supposed to be necessary only in large cities.

Water Storage Reservoirs.

The State Water Supply Commission of New York has issued a pamphlet in which the construction of storage reservoirs by the state is strongly advocated. The benefits to be derived from the construction of such reservoirs are described at length and may be briefly summarized as follows:

(1) The equalization of stream flow by storing the water during wet seasons and using the same to increase the volume of the stream through dry seasons.

(2) A consequent large increase in the power value of the stream, due to augmenting the low water flow, and thus doubling or trebling the dependable flow for power purposes.

(3) A consequent decrease in the height of freshets, thereby reducing the great pecuniary damages caused by the periodic recurrence of floods.

(4) By increasing the low water flow of polluted rivers a dilution would result which would improve the sanitary conditions on the streams.

(5) Navigation would be benefitted by a higher stage of water on the lower reaches of the river.

(6) The extension of transportation facilities, often to an important and desirable extent, by navigation on the proposed reservoirs.

(7) The low lands of the river valleys could be made somewhat more tenable, and their agricultural products increased by reducing the contingency of floods.

(8) The perpetual submergence of extensive tracts of swamp lands, which are now unsightly and a menace to health, would be possible.

(9) The creation of extensive lakes with beautiful shores offering desirable locations for permanent homes, and great attractions to summer visitors seeking recreation and health.

(8) Inestimable indirect benefits to the state due to the stimulation of industrial enterprises; the increase in number and prosperity of the people, and the creation of taxable wealth by the progressive development of water powers.

The Water Supply Commission as a part of its last annual report to the Governor and Legislature submitted a bill providing for a systematic development of the waterpower resources of the state under state control. This bill contemplated the return of a net revenue to the state and accordingly provided for the assessment of benefits upon individuals and properties benefitted by reason of the construction and operation of storage reservoirs. Many of the provisions of this bill were new in principle and it was to be expected that a measure of such far reaching effect would meet with some opposition. Although the bill provided for contracts to be entered into with respect to payments for benefits to be conferred and the power of assessment was only to be resorted to in order to forestall an unwilling beneficiary from blocking the progress of a great public enterprise, such a provision met with disapproval in the Legislature and the bill was not advanced. The Commission believes that as the Legislature becomes more familiar with the problems involved, it will approve of this policy. For these reasons, the bill with amendments in other respects will again be submitted to the Legislature in connection with the next annual report.

Numerous complaints have been filed with the Commission alleging unsatisfactory domestic or fire service both on the part of municipalities and water companies. The source of dissatisfaction seems to be the lack of foresight on the part of the municipal or water company officials as a result of which they have obtained an inadequate supply or insufficient pressure. These complaints seem to indicate the need of some supervision of such departments by the state and it

is probable that such control will be assumed in the future.

Water Supply of Somerville, N. J.

Mr. Nicholas Hill, consulting engineer, has offered a report on the solution of the water supply situation in Somerville, N. J. Mr. Hill was employed after a mass meeting of citizens of Somerville last month, and has since been engaged in making surveys covering a radius of 15 miles around that city.

The citizens of the borough at the above mentioned mass meeting voted an appropriation of $2,000 for the investigation, and the consulting engineer, through a special committee of the Borough Council, presented a report on the sources of water supply in Central New Jersey that are not pre-empted. One interesting feature of the report is that a mysterious water syndicate has captured about every source of supply in that section that is not pre-empted, by acquiring mill rights along all the tributaries of the north branch of the Raritan river, and the borough will have to pay the syndicate damages for mill rights in obtaining its water supply. All this the engineer figures in on the cost of a municipal plant.

The syndicate has spent ten years in quietly buying up these mill rights, but in the secrecy which it has observed in guarding its plans for capturing the Raritan and its tributaries for a great water supply it has failed to declare its intention in detail to the State Water Commission, and in this particular it has been forestalled by the borough officials, who have served notice on the State Water Commission that they are now surveying the north branch and its tributaries, with the object of condemning a water supply of 4,000,000 gallons a day for the borough.

The project recommended by the special committee of the council is that of obtaining a supply from the north branch of the Rockaway river at Mountainville, a distance of 13 miles from the borough. This is reported to be the best water supply in the state.

Exhaustive tests have proven the water to be of such purity and softness that it will not need filtering. The supply can be brought to the borough by gravity and will need no pumping stations, and at the same time there will be a pressure of sixty-two pounds in the mains, which will be adequate for fire purposes. The estimated cost of a great concrete dam at Mountainville and a plant that will provide for the borough for the next twenty years is $370,000.

The other sources of supply proposed by the engineer are from the North Branch river, near North Branch, at a cost of $218,000; from the Black river, near Pottersville, at a cost of $23,200, and from sunken wells near the Raritan river at Finderine, at the cost of $40,000, but all of these projects will require pumping stations and filtration plants, which will greatly increase the cost of operation and produce an inferior quality of water.

LIGHTING

Philadelphia Electrical Bureau—Mukden Lighting Plant—Broadways and Brightways—Flow of Gas—Pasadena Lighting Plant

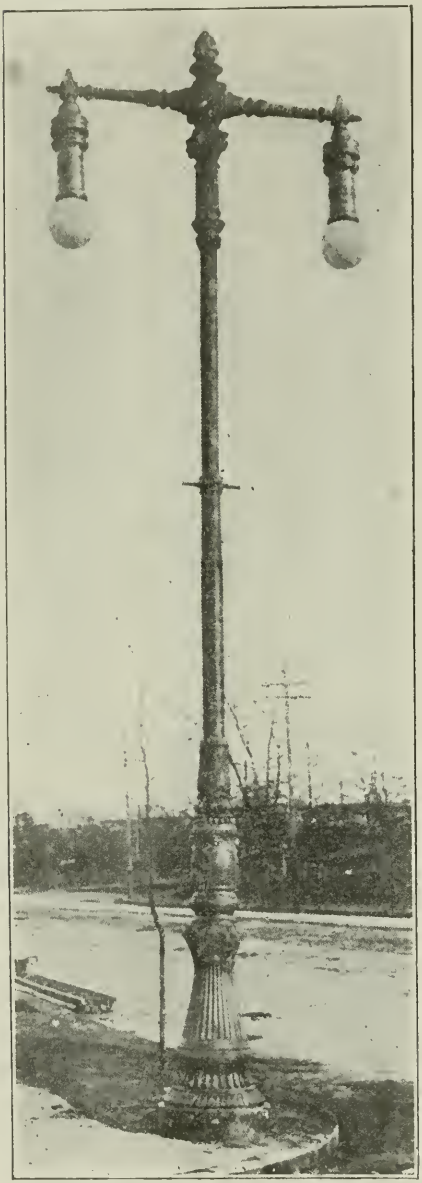
The Electrical Bureau of Philadelphia.

The growth and development of electrical devices for quick communication, and the application of these to the workings of municipal affairs, has made the electrical bureau one of the most important departments in municipal management. To such a bureau if properly managed is due the credit for quick and efficient work in the departments of fire and police protection; and further, the safety of the public is guarded by a proper inspection of wiring, street signs, moving picture shows, etc. A recent number of "Philadelphia" gives an account of the electrical bureau of that city.

All the electric lighting of the city streets, represented by 12,305 arc lights is under direct supervision of the bureau. It is the bureau's duty to pass upon construction and power of lamps and to see that service is maintained under conditions of the contract. It also has supervision of electric lighting and power installation work in private homes and business buildings through its control and supervision of the whole system of underground and overhead wires, and is charged with the duty of inspecting all places of amusement where electrical lighting is used.

In its hands is placed the great responsibility of providing and protecting a system of telephone and telegraph communication so complete in all details that the handling of fire danger becomes a science, and safety of life in the home section and property in the business sec-

tion is reasonably insured. The electric wiring which makes possible operation of 650 miles of rapid transit facilities comes under the supervision of the Electrical Bureau, so that even the incident of con-



ORNAMENTAL LAMP-POST
PHILADELPHIA.

veyance from home to business depends in a measure upon its vigilance.

The mere enumeration of the various lines of activity under direction of the Electrical Bureau should, in itself, carry a convincing message to the mind of all concerning the importance of its work, but when these various activities are analyzed their importance becomes more clearly established.

Take, for example, the service performed in connection with the police and fire departments. Signals from the fire-boxes located throughout the city, and messages over the police telephone, aggregated last year 6,848,701 separate communications between outlying districts and headquarters. This means that every five seconds, in every hour of every day and night, during the year 1909, a communication, important in character and affecting the well-being of the citizen, was transmitted over the city's system of wires. A failure in the transmission of any one of these seven million messages might have resulted in serious loss of life or property, and yet not one failure in service occurred during the whole twelve months.

Philadelphia is the only city in the country which has direct wire connections between police headquarters and all pawn-brokers' establishments. By means of this system of instant communication with places where thieves generally make their first effort to dispose of stolen property, the officials of the city are able frequently to secure a criminal at his first effort to realize on goods stolen, because notification of theft and description of property can be placed in every pawn-broker's office within five minutes after the robbery has been notified at the nearest police station, although that station may be ten miles from headquarters.

The Electrical Bureau also designs permanent illumination features for parks and public buildings as well as all of the smaller fixtures for use within the city hall and other city buildings. In fact the Electrical Bureau, in addition to its general direction and care of electric work, originates nearly all of the designs used in all branches of the work and many of its most important facilities are under patents which originated with the bureau. In this matter of office designing, or the more ambitious planning for large outside work, there is indicated an important division of the bureau's responsibility little appreciated by the general public. Take the following incident as an illustration:

One of the most important pieces of work confided to the supervision of the Electrical Bureau of late years has been that of relighting Philadelphia's business center. After a careful investigation of lighting methods followed in other cities in this country and abroad, it was determined to inaugurate a new system of ornamental lighting to cover the heart of what was the original city.

To this end the chief of the bureau called into consultation the architects of the city and members of the T Square Club identified with that profession, sub-

mitting to these representative men plans and specifications, with a view to organizing a competition in connection with the designs for the new electric light poles. Upon the advice of these high authorities it was decided that the design for the poles should be made the subject matter of a contest in the forthcoming competition for the Cope Memorial Prize, and designs for this competition were submitted and hung in the exhibition rooms of the Academy of Fine Arts. The design which won first prize in this Academy of Fine Arts competition was the one adopted by the city and erected on the city streets. An accompanying photograph shows the type of arc light pole adopted. The design was awarded the Cope Memorial Prize, and the plans and specifications were prepared by the Electrical Bureau.

The chief of the Electrical Bureau has since established a museum at City Hall showing all methods of lighting now in use, with a series of lamps illustrating lighting methods running back more than 3,000 years. Perhaps the most gratifying feature of the administration of the city Electrical Bureau is that it is practically self-supporting, license fees collected and rent paid for city ducts and cables providing a revenue 10 per cent. greater than its entire payroll, while the city receives free electric lighting service valued at $75,200 a year.

The Light Plant at Mukden, Manchuria.

The Far Eastern Review contains an account of a municipal light plant in a country that is usually considered to be among the "benighted." The movement towards obtaining this plant was started in 1908 under a coterie of public officials of which H. E. Zang Shaoiji, governor of the province, was leader. Under this administration an appropriation was made for a lighting system for Mukden; it being proposed to furnish light for the government yamens and streets.

The first plans called for a rather limited plant, as commercial lighting seemed rather hopeless at first, owing to the cost, and the fact that all shops close at sundown and the inhabitants as a rule retire very early.

In building the plant and constructing the lines a great many peculiar conditions were encountered, and new problems are constantly being met.

Due to the number of poorly constructed telephone lines and the inflammable interior walls and ceilings of houses, special attention and extra precautions have been taken to protect all circuits with enclosed safety fuses. Double the number of fuses that are used in American or European practice have been placed in the circuits. Wires of ample size have been used and special efforts have been made to securely fasten wires to insulators. The poles are set deep and are well guyed, and strong cross-arms with iron insulator-pins support insulators designed for a much higher voltage than that in use.

The entire work of installation was completed with remarkable celerity. The engineer of the General Electric Company, who had the matter in charge, arrived in Mukden the first of July, 1909, and began the organization of several gangs of workmen and drew plans for power station and pole line arrangements. House wiring was started in the government yamens about August 1, and the erecting of power station machinery August 15. The plant was given a twelve hours test run on September 30, and put in operation with about one thousand lights, October 3. The G. E. series tungsten street lighting system which was put in operation in November, shortly after the arrival of another shipment of equipment, has been generally approved by the officials and public, and is giving every satisfaction, as it is peculiarly adapted for the streets of a Chinese city.

The following data are in brief descriptive of the present plant:

Normal capacity of present plant, 5,000 lights—16 c.p.; lights in operation, 5,000 —carbon; street lights, 60 c.p., 300 series tungsten; miles of streets lighted, 10; miles of pole line constructed, 23; miles of wire on poles, 70; capacity of line wires, 20,000 lights; transformers installed, 62; capacity of transformers, 8,000 lights.

Shortly after putting the plant in operation the management was convinced that it would be loaded to its capacity before the following spring, and arrangements were made for its extension. Owing to the high cost of fuel, the most efficient machinery is the most economical and it was decided to install a 600 h.p. Curtis steam turbine driving General Electric dynamos of 400 kilowatts capacity. To add to the reliability of the plant, a separate small turbine-driven dynamo of 20 kilowatts capacity was installed. The steam from the turbines is condensed in Wheeler surface condensers under high vacuum held with electric motor-driven pumps. The condensed steam is pumped direct to the boilers and used continuously. Babcock & Wilcox boilers of the latest design were installed and equipped with automatic mechanical stokers. A super-heater is integral with the boilers to eliminate the danger of water in the steam. The boiler capacity is sufficient for the two turbines. The present system has a capacity of 12,000 lights.

Although power for lighting is sold by meter cheaper than in other cities in China, the receipts for lighting service have considerably exceeded expenses from the start, and with the plant completed, the receipts will cover operating expenses and cost of extensions, and leave a reasonable profit on the invested capital, while the increased demand not only for

lights, but for heating and power equipment seems to assure the success of the Mukden plant.

Broadways and Brightways.

The above is the phrase chosen to designate the cluster-light street lighting system of Indianapolis, as a result of a competition conducted by the Indianapolis Commercial Club. The contest was instituted some months ago and attracted a great deal of attention, as over 2,500 suggestions were submitted to the committee of judges.

Many of the contestants sent letters explaining the good points of their suggestions. Some of these were in verse. Some were convincing—others not. But all were interesting and worth while.

Phrases which included the word "way" predominated, there being nearly 100 of these. "Trail" was also a favorite, and "road" had many to urge its availability. Almost every word which could be associated with light was used in some form or other.

Just to give an idea of the way the suggestions ran, a number of them, selected at random, follow: Aurora Indianapolis," "Thoro-lighted," "The Comet's Tail," "Chantecler," "Strands of Sunshine," "Tungstolight," "Sol's Substitute," "The City Brilliant," "The Brite Lites," "Luminar Place," "Moon Pike," "Shino-Way," "Firefly Promenade," "Pearls on Poles," "Five Light District," "The Great Light Way," "Sparkle Avenue," "Gloom-No-More," "The Nineteen-Hour-Every-Day-Spot," "Blocks of Five," "The Milky Way," "Sunshine Alley," "White Streak," "Golden Glow," "De-Lightful," "Glow Worm Walk," "Path o' Pearls," and Indianapolite."

Letters and suggestions were received not only from Indianapolis, but from all quarters of Indiana, from Colorado, California and many other states. The suggestions were copied and numbered so that the committee did not know the name of the winner until after the choice had been made. The number of suggestions received indicates the popularity of the new system.

Flow of Gas in Pipes.

Professor E. A. Hitchcock of Ohio State University and Samuel S. Wyer, M. E., made recently a report on natural gas service rendered the city of Columbus, O., which contains much material of value in the investigation of the operation of both natural and artificial gas plants. The discussion of the flow of gas in the main transmission line is abstracted as applicable to any gas main. The results were obtained by the use of the most approved apparatus and the variations in rate of flow of gas in various parts of the cross section of pipes were determined by means of Pitot tubes. Following are the paragraphs regarding the determination of the flow of gas in the main transmisison line:

The main transmission line, which connects the pumping station with the city of Columbus, has a nominal diameter of 10 inches and a total length of 26.2 miles. It was the intention to investigate the flow through this line under different conditions of velocity while the pumping station was in operation. This we were unable to do until the station was closed down, when the flow was maintained by the pressure of the field.

A second Pitot instrument having the same form of tips as the one used on all work was connected to the transmission line .2 mile below the pumping station, while the traversing instrument was connected to the line just above the main gate valve at the Fifth Avenue measuring station at Columbus, making a distance between instruments of 26 miles. Thermometers were also inserted in the line at the two points. The pressure gauges used on the Pitot instruments were calibrated before and after the tests, and every precaution taken so that the results obtained for quantity of flow at the two points would be absolutely comparative, and therefore the difference shown would be the line loss due to leakage for the pressures prevailing at the time. A series of readings were taken the evening of July 6, followed by another series beginning at 6 a. m. on the following day. The demands were such that constant conditions for the whole line were not maintained until 8:40 a. m., when the following readings were obtained:

AT THE PUMPING STATION.

Time.	Pressure.	Pitot.
8:40	87 lb.	.45 inches
8:45	87 lb.	.45 inches
8:50	87 lb.	.45 inches
8:55	87 lb.	.45 inches
9:00	87 lb.	.45 inches
9:05	88 lb.	.45 inches
9:10	88 lb.	.45 inches
9:15	88 lb.	.45 inches
9:20	88 lb.	.45 inches
9:28	88 lb.	.45 inches
9:30	88 lb.	.45 inches

AT FIFTH AVE., COLUMBUS.

Time.	Pressure.	Pitot.
8:41.5	66.7 lb.	.50 inches
8:45.5	66.7 lb.	.50 inches
8:47.5	66.1 lb.	.50 inches
8:51.5	66.7 lb.	.50 inches
8:55.5	66.7 lb.	.50 inches
8:59.5	66.7 lb.	.50 inches
9:03.5	66.7 lb.	.50 inches
9:07.5	66.7 lb.	.50 inches
9:11.5	66.7 lb.	.50 inches
9:15.5	66.7 lb.	.50 inches
9:19.5	66.9 lb.	.50 inches
9:21.5	66.9 lb.	.50 inches
9:25.5	67.2 lb.	.50 inches

The temperature of the flowing gas during the above period was 71 degrees F. at first instrument, and 73 degrees F. at Fifth Avenue.

For computing the quantity of gas flowing at the two stations the average corrected readings are as follows:

PUMPING STATION.

Pressure, 87.5 lbs.
Pitot, .45 inches alcohol.

Temperature, 71 degrees F.
Diameter pipe, 10.13 inches.
Cu. ft. per hr. at 60 degrees, 238,120.
Cu. ft. per 24 hrs. at 60 degrees, 5,714,880.

FIFTH AVENUE.

Pressure, 66.77 lbs.
Pitot, .50 inches alcohol.
Temperature, 73 degrees F.
Diameter pipe, 10.13 inches.
Density, .622.
Cu. ft. per hr. at 60 degrees, 223,730.
Cu. ft. per 24 hr. at 60 degrees, 5,369,520.

The difference between the quantities as determined for the two points would be the leakage loss for the pressure condition prevailing or 345,360 cu. ft. per 24 hours.

At Fifth Avenue measuring station the pressure is reduced to whatever pressure is being maintained in the high pressure lines of the city distribution system. At the times the above results were obtained this pressure was about 15 lbs. In the station is located a Pitot instrument, the tips being connected to the 10-inch line below the regulator. This instrument, therefore, should indicate the same quantity of gas as shown in the high pressure line. To verify this some readings were taken on the station instrument at the same time as those were being obtained on the line, and the quantity of gas computed from the tables as used by the company. The readings taken with the results obtained are as follows:

—Time, 5:42 p. m.—

Line Instrument—Pressure, 57 lbs.; Pitot reading, 80 inches alcohol; gas per hour, cu. ft., 265,600.
Station Instrument—Pressure, 16 lbs.; Pitot reading, 1.7 inches water; gas per hour, cu. ft., 316,370.

—Time, 8:54 a. m.—

Line Instrument—Pressure, 66.7 lbs.; Pitot reading, .50 inches alcohol; gas per hour, cu. ft., 223,730.
Station Instrument—Pressure, 14.5 lbs.; Pitot reading, 1.23 inches water; gas per hour, cu. ft., 263,400.

Comparing these results, that is, taking their ratio, we find for the first case the quantity by the station instrument is .8424 of the main line, and for the second case .8328 of the amin line, thus indicating that the station instrument gives results some 16.2 per cent. high.

In estimating the capacity of a transmission line having given the initial and terminal pressures, the following Oliphant formula is generally used:

$$Q = C\,a\,\sqrt{\frac{P^2 - p^2}{l}}$$

Q equals cu. ft. gas discharged per hour.
c equals constant 42.
a equals factor depending upon diameter of pipe.
P equals initial pressure plus 14.4 lbs.
p equals terminal pressure plus 14.4 lbs.
1 equals length of line in miles.

Applying this formula to the 10-inch line on which observations were made, and solving for the constant C, where

Q equals 227,800
a equals 368 for pipe 10.13 inches diameter
P equals 102
p equals 81.1
1 equals 26 miles,

we find that C equals 50.8 instead of 42. In another case where the drop on the same line is extreme as shown for January 7, 1910, at 6 p. m., where the quantity corrected for the station Pitot instrument is

Q equals 490,200 cu. ft. per hr.
P equals 219.4
p equals 52.4
2 equals 368
1 equals 26½ miles, ½ mile for cooler, valves and fittings, we find C equals 32.2.

In applying the same values as above to the Robinson formula

$$Q = C\,\sqrt{\frac{a^5}{l}\,(P+p)\,(P-p)}$$

where the constant C is taken 48.4, we find for the first case the constant equal to 57.53 and for the second case of high velocity the constant equal to 37.45.

Our observations, therefore, indicate that the constants which are generally used with formulae for pipe line flow should change with the velocity or drop in pressure per mile.

The Municipal Lighting Works of Pasadena, Cal.

The municipal electric light plant of Pasadena, Cal., is now about two years old and has not yet attained its full patronage, but is able to show remarkable results and surplus sufficient to retire $8,125 of the bonds issued to raise money to construct the plant. The total bond issue in 1906, 1908 and 1909 was $325,000, and this has been reduced to $306,250 by payments from earnings since the plant began operations. Interest at 4 and 4½ per cent amounts to about $12,500 a year and is of course decreasing as the indebtedness decreases.

The station has a capacity of 1,500 k.w. in three connecting units. The transformer capacity of the distributing system is 1,900 k.w. There are 4,275 poles and the street lighting system consists of 296 arc lights, 966 40-c.p., 17 60-c.p., 25 80-c.p., 16 200-c.p. tungsten lights, 53 32-c.p. carbon lamps, and 130 cluster posts of 13 lights each. There were 2,357 meters in use July 1 and orders were then in hand for setting 1,399 more. The preliminary estimates of successful operation of the plant assumed 4,000 consumers so that the success with approximately half this number is still more remarkable.

Another source of reduction in revenue is the reduction in rates which took effect September 1, which will neutralize the effect of the increase in number of customers, at least in part. The plant runs in competition with the Southern California Edison Co., which formerly charged 12½ cents per kilowatt hour.

The municipal plant began with charging 8 cents per k.w. hr., which was reduced for the last 7 months of the year to 7 cents per k.w. hr. The new reduction is to 5 cents, which is the rate now charged by the competing company. That company is a large one with plants in Los Angeles and other cities and towns, and so is not dependent wholly upon Pasadena for its profits.

The competition of the municipal plant has reduced the cost of electric lights to consumers more than one-half, and gratitude and public spirit should insure the 4,000 customers necessary for success at the 5-cent rate as quickly as they can be connected. This would still leave more than 2,000 possible customers.

Under the very reasonable rates of the past year the plant has saved to its customers from $90,000 to $100,000 from what they would have been obliged to pay under the old rate. In addition it has paid all the expenses of maintenance and operation, the interest on bonds, the $8,125 of bonds above mentioned, and had a surplus of $15,362.14 for application on depreciation account, which is nearly 4½ per cent on the average investment for the year, $350,000. The reduction in rates from 7 to 5 cents per k.w. hr. will reduce the net receipts for the current year some $1,000 or $1,200 a month, and this must be made up by additions to the list of customers if the good financial record of the past year is to be duplicated, although the plant will pay its way, except as regards a surplus to equate the depreciation account.

The manufacturing cost for the past year was 1.24 cents per k.w. hr., the distributing cost was 0.87 cent, and the total cost for manufacturing and distribution was 2.11 cents.

The total earnings for the year were, for street lighting, $33,311.24; city buildings, $1,129.80; commercial light and power, $40,494.28; total, $74,935.32, an increase of nearly $30,000 over the preceding year.

The total manufacturing cost for the year was $22,719.28; the distribution cost $8,416.55; the general expenses $7,493.58; total, $38,629.41; to which must be added the expenditures for interest and payment of bonds, as above, to give the total expenditures.

Of the balance remaining, $13,537.76 was transferred to the construction account. The total expenditures for construction were $109,360.96, most of this sum having been carried over from the preceding year and being the proceeds of the sale of bonds.

It is confidently expected that the results of the reduction in rates will be fully appreciated by the citizens and that they will promptly come to the support of the plant which has done so much for them and insure the 4,000 customers necessary to the fullest success, and supply even more.

ROADS AND PAVEMENTS

Convicts on Roads—Oklahoma Asphalt Pavements—Vitrified Brick Construction—New York Subway Extensions—Flushing Pavements—Asphalt Repairs

Vitrified Brick Street Construction.

The secretary of the National Paving Brick Manufacturers' Association, Mr. W. P. Blair, has prepared an account of the "trip for observation, inspection, investigation and study of vitrified brick street construction," which was taken by members of committees from the American Society of Municipal Improvements and the Organization for Standardizing Paving Specifications, upon invitation of Mr. Blair and his associates, July 18 to 21. A general description of the trip was given in MUNICIPAL ENGINEERING, September number. The present booklet, 265 pages, is illustrated with half as many more pages of photographs taken on the trip. It contains a word of explanation regarding the reason for making the trip; a list of those present during all or part of it; descriptions of the Indianapolis streets and the Speedway, illustrated by photographs; the same of Terre Haute and its examples of all grades of construction, with numerous detailed photographs, of much value because showing correct construction and showing the reason for defects in streets not correctly constructed; the same of Cincinnati showing mainly defective construction; the same of Columbus, showing much better streets than in Cincinnati, and the reasons therefor.

The exhibits of the results of the rattler tests of brick in progress in Professor Orton's laboratory at Columbus are shown by tables of measurements and weights and photographs of the bricks after passing through the tests. This is a most interesting and instructive exhibit and will be given later. These tests are still in progress and the full program has not yet been completed, so that conclusions can not yet be drawn.

Still better streets in Cleveland are de-

scribed and illustrated on a number of pages, and several of the roads in Cuyahoga County outside of Cleveland are shown also. Several pages of comment on Cleveland show the opinions of the writer thereof concerning the reasons for the excellence of these pavements and roads. They were a revelation to most of those making the inspection. This comment is followed by statements made by all of those present at dinner at the close of the inspection trip, and they all practically agree with the said writer in their expressions regarding the excellence of the pavements and the reasons therefor.

This beautiful and instructive souvenir of the trip was sent to each of the participants and will serve to keep warm the recollections of the trip and the good opinions formed of properly constructed brick pavements.

Asphalt Pavement in Oklahoma.

Oklahoma City, Okla., is making preparations for a large amount of paving during the coming year. On September 19 contracts were let for 16.75 miles of asphalt pavement, comprising 302,670 square yards. The total estimated cost is $984,237.33. The total quantity of excavation estimated includes 237,030 yards of earthwork and 6,700 yards of rock cut, with only about 16,900 yards of embankment. The earth excavation is estimated at 35 cents and the rock at 70 cents. Mr. W. C. Burke is city engineer.

Bids Wanted for Subways in New York City.

The Public Service Commission for the first district of New York is asking for bids for various subways, to be received October 20 and 27.

For the first date is set the Tri-Borough Rapid Transit Railroad, one part beginning under Battery Park, near the waterfront, in the Borough of Manhattan, and running under Greenwich street, Church street, and Broadway (with a connecting line running east and west under Canal street) Irving place and Lexington avenue, under the Harlem river to 135th street and Park avenue, in the Borough of The Bronx, where the line divides. The east side branch extends under Park avenue to 138th street, thence under 138th street, the Southern Boulevard, and Whitlock avenue to a point south of Westchester avenue, where the line emerges and becomes an elevated railroad, thence continuing along Whitlock avenue and Westchester avenue to Pelham Bay Park. The west side branch, beginning at 135th street and Park avenue, extends under Mott avenue, Franz Sigel Park and other streets to a point near River avenue and 147th street, where the line emerges and becomes an elevated railroad, thence continuing along River avenue and Jerome avenue to Woodlawn road. The connecting line in the Borough of Manhattan under Canal street begins near Chrystie street and extends westerly under Canal street and Watts street to West street. In the Borough of Brooklyn, the railroad consists of several portions. One portion, which begins in Fourth avenue near Forty-third street, runs under Fourth avenue to Fort Hamilton, and another portion beginning in Fourth avenue near Fortieth street runs under Fortieth street, New Utrecht avenue and Eighty-sixth street to a point between Twenty-third and Twenty-fourth avenues, where it emerges from the gound and becomes an elevated railroad, thence continuing over Eighty-sixth street and Stillwell avenue to Coney Island. The other portion of the railroad in Brooklyn consists of two branches. One branch begins at the Brooklyn terminal of the Williamsburg bridge and runs as a sub-surface railroad under the plaza of Williamsburg bridge and Broadway to a point between Green avenue and Lexington avenue. The other branch begins under Fulton street near Ashland place and runs under Fulton street, Lafayette avenue and Kossuth place to Bushwick avenue.

For the latter date are set two subways. One, the Lexington avenue route, begins under Battery Park and extends thence under Battery Place, Greenwich street, Trinity Place, Church and Vesey streets and Broadway, Irving Place, Gramercy Park and Lexington avenue, the Harlem river and Park avenue to East 135th street. Here the line divides into two branches. The west branch begins at East 135th street and extends under East 135th and 138th streets, Mott avenue, Franz Sigel Park, River avenue near East 157th street. The east branch extends under Park avenue, Canal street West, and East 158th street to a point near Alexander avenue.

Another, the Canal street route, begins in Watts street at West street, and extends northeasterly under Watts street to Canal street, and thence easterly under Canal street to Broadway, thence under Canal street and the existing subways in Lafayette street and Center street to the Bowery.

The Brooklyn and Manhattan loop lines begin at the Brooklyn terminal of the Williamsburg bridge, at or near Driggs avenue, and extend thence under the plaza of the Williamsburg bridge to Broadway at a point near Marcy avenue; thence under Broadway to a point about midway between Greene avenue and Lexington avenue. The second part begins at a point near Bushwick avenue and extends thence westerly under Kossuth place and under the projected subway in Broadway to Lafayette avenue; and thence westerly under Lafayette avenue to Fulton street; and thence under Fulton street to a point at or near Ashland place, where a connection can be made with a subway now under construction.

Cost of Maintaining Asphalt Streets in Brooklyn.

The accompanying tables give in detail the cost of maintaining asphalt streets in Brooklyn. They are self-explanatory.

ANALYSIS OF COST OF MAINTENANCE OF STREETS.

	Wearing surface per box.	Wearing surface per cu.ft.	Binder per box.	Binder per cu.ft.
Superintendence	0.094	0.011	0.094	0.011
Superintendent's automobiles	0.067	0.008	0.067	0.007
Repairs to plant	0.090	0.010	0.090	0.010
Repairs to tools	0.049	0.006	0.049	0.005
Dumping privilege	0.059	0.007	0.059	0.007
Coal	0.113	0.013	0.113	0.113
Wood	0.058	0.007	0.058	0.006
Miscellaneous supplies	0.031	0.003	0.031	0.003
Depreciation	0.178	0.020	0.178	0.020
Rent	0.062	0.007	0.062	0.007
Interest	0.089	0.010	0.089	0.010
Taxes	0.026	0.003	0.026	0.003
Total general costs	0.916	0.105	0.916	0.102
Material Costs:				
Asphalt	1.030	0.118	0.377	0.042
Residuum oil	0.083	0.009	0.035	0.004
Sand	0.344	0.039	.....	.....
Stone dust	0.078	0.009	.....	.....
Binder stone	.....	.....	0.471	0.052
Total material costs	1.535	0.175	0.883	0.098
Labor and Trucking Costs:				
Plant labor, including foremen	0.809	0.092	0.809	0.090
Street labor, including foremen	2,163	0.247	2.163	0.240
Trucking	0.556	0.064	0.556	0.062
Total labor and trucking costs	3.528	0.403	3.528	0.392
Total Costs:				
General costs	0.916	0.105	0.916	0.102
Material costs	1.535	0.175	0.883	0.098
Labor and trucking	3.528	0.403	3.528	0.392
Grand total of costs	5.979	0.683	5.327	0.592

ANALYSIS OF COST OF RESTORING OPENINGS IN STREETS.

Total general costs as above	0.916	0.105	0.916	0.102
Total material costs as above	1.535	0.175	0.883	0.098
Labor and Trucking Costs:				
Plant labor, including foremen	0.809	0.092	0.809	0.090
Street labor, including foremen	2,051	0.235	2.051	0.228
Trucking	0.710	0.081	0.710	0.079
Total labor and trucking costs	3.570	0.408	3.570	0.397
Total Costs:				
General costs	0.916	0.105	0.916	0.102
Material costs	1.535	0.175	0.883	0.098
Labor and trucking costs	3,570	0.408	3.570	0.397
Grand total costs	6.021	0.688	5.369	0.597

TABLE SHOWING MONTHLY COSTS, PRODUCT, AND BOX COSTS.

January	1,154.02	.....	.....	64	36	..
February	1,365.12	.....	.....	59	39	2
March	6,366.43	1.788	3.56	28	57	15
April	7,142.82	2.589	2.76	22	61	17
May	8,049.23	3,019	2.98	18	64	18
June	1,211.86.65	3,891	3.11	18	64	18
July	6,433.89	1,665	3.86	22	61	17
August	9,803.33	2,294	4.27	22	61	17
September	7,191.71	1,853	3.88	24	60	16
October	7,963.96	2,432	3.28	22	60	18
November	8,959.28	2,472	3.62	21	60	19
December	4,231.29	1,110	3.81	23	59	18
Totals	81,895.18	23,113	3.541	23	60	17

TABLE SHOWING COST OF MAINTENANCE OF ASPHALT PAVEMENT, YEAR 1909.

Year Laid.	Material Used in Repairs. wear. surf. cu. ft.	binder. cu. ft.	Total cost.	Yardage.	Years past guar.	Cost of maint sq. yd
1886	.....	.....	.....	235	18	....
1887	991.46	193.50	$791.71	4,763	17	.0166
1888	5,796.80	763.50	4,411.22	44,141	15	0.10
1889	5,524.40	899.00	4,305.37	43,162	15	0.10
1890	962.48	193.50	771.92	16,647	14	0.046
1891	5,902.54	2,055.50	5,248.30	25,124	13	0.209
1892	2,408.67	561.50	1,977.53	33,313	12	0.059
1893	1,021.47	221.50	828.79	20,359	11	0.041
1894	5,208.10	1,249.50	4,296.84	59,496	10	0.072
1895	13,594.12	2,825.00	10,957.20	164,203	9	0.067
1896	8,899.23	1,868.00	7,184.04	189,349	8	0.038
1897	32,445.00	6,622.75	26,080.62	425,442	7	0.061
1898	1,807.14	500.50	1,530.56	51,826	6	0.295
1899	426.55	90.00	344.61	51,923	5	0.007
1900	2,325.89	576.75	2,271.51	124,603	4	0.018
1901	2,118.91	816.50	1,930.58	74,651	3	0.026
1902	3,381.75	769.50	2,765.26	336,754	2	0.008
1903	17,416.82	6,780.50	15,613.76	877.803	1	0.013
1904	96.25	18.00	76.39	684,135	..	0.000
Totals	110,827.58	26,505.00	91,386.21	3,227,929	..	0.023

COMPARATIVE COSTS OF MAINTENANCE OF ASPHALT PAVEMENTS PER SQUARE YARD OF TOTAL YARDAGE OUT OF GUARANTEE, TOGETHER WITH UNIT PRICES FOR WORK.

	Municipal Asphalt Plant.				Contract System.				
	1909	1908	1907 Jul-Dec.	1907 Jan-Jun	1906	1905	1904	1903	1902
Unit—Surface	0.698	0.844	0.852	0.81½	0.56	0.67	0.85	0.95	0.90
Prices--Binder	0.597	0.737	0.745	0.35½	0.25	0.25	0.30	0.40	0.50
All streets	0.028	0.0384	0.0559		0.0350	0.0345	0.0422	0.0732	0.0579
Railroad streets only	0.089	0.0637	0.1390		0.0630	0.0720	0.0681	0.14.5	0.1780
Non - railroad streets	0.021	0.0353	0.0481		0.0321	0.0314	0.0392	0.0644	0.0418

Summary of costs of maintenance for the year 1909 of all the asphalt pavements in Brooklyn out of guaranty.

All streets	3,227,929	$91,386.21	0.028
R. R. streets.	348,240	30,877.10	0.089
Not R. R. sts.	2,879,689	60,509.11	0.021

The unit prices given are per cubic foot of material measured in trucks, as deliverd on streets. The costs of maintenance are given per square yard, and are the total cost, divided by the total yardage in the respective classes.

Convict Labor on Roads.

Mr. W. S. Blatchley, State Geologist of Indiana, strongly recommends the employment of prison labor on the construction and maintenance of public roads. His plan for doing this is as follows:

Let the general assembly authorize the purchase of an extensive bed of shale in western Indiana and the erection on it of a modern paving brick factory. Equip this factory with convict labor and put several hundred additional convicts to breaking stone for foundation and cutting it for curbing. This brick and stone can then be furnished at the plant at less than one-sixth present prices to these counties devoid of other road material, or may be given them if they are not willing to buy it. The cost of a paving brick plant, completed for work, which has a capacity of 40,000 output per day, is about $55,000. One with double the capacity costs about $70,000. The greater amount of this expense is for buildings and kilns, which could, by convict labor, be constructed of brick made on the spot, so that the cost to the state would be less than half this sum.

After the plant is once in operation, with fuel and raw material both at hand, the only outlay is for labor. Where the daily output is 80,000 brick, and the fuel is mined in connection with the shale, the number of hands necessary is about one hundred. These at $1.50 each per day, would make the cost of the brick about $2.25 per thousand. With convict labor the actual cost of the brick would only be the sum paid out for the maintenance of the prisoners. It costs 40 cents a day to maintain a convict. To this add 50 per cent. for wear and tear on tools, etc., and the cost would not exceed 60 cents a day. A year's output would be sufficient to pave 125 miles of roadway. There are forty-two brick to a square yard of roadway and 503,000 to a mile of roadway twenty feet wide. The cost of this brick by convict labor would thus be $300. The crushed stone could be prepared by convict labor within the prison at not more than 30 cents a cubic yard. Adding this to the cost of the brick makes the cost of the material for one mile of road $665.

Not only could brick and macadam be made for roadways in the prison which I have in mind, but all brick, both ordinary and pressed front, could be made for all public buildings, such as jails,

court houses, school houses, insane asylums and county infirmaries. The shale and fire clay is in every way suitable for such material, and it could be furnished at cost, which would not be over $1.50 per thousand for the finest of pressed front and ordinary brick. The public pay the taxes to erect such buildings, and also the taxes for maintaining the prisoners. Why not, then, have those prisoners prepare the material for public buildings and so lessen the tax burden of the people?

In this connection it might be mentioned that Minneapolis makes use of her short-term prisoners in the city workhouse, to do just such work as Mr. Blatchley advocates. The greater portion of the male prisoners are employed in the manufacture of brick from clay found on deposit within the workhouse grounds. About 160 men are employed in this labor and the output of the plant is 40,000 brick per day which are sold for $6 per thousand. Mr. F. R. McDonald, the superintendent of the Minneapolis institution, states that the general condition of the prisoners, their attitude toward their work and their physical condition is improved by their being allowed to do this work.

Flushing Pavements with Water Under High Pressure.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The above heading is quoted from an article in your May issue, vol. xxxvi, p. 307, entitled "Causes and Prevention of Defects in Asphalt Pavements." by Isaac Van Trump, Chicago, Ill. The article includes "flushing with water under high pressure" as one of the "causes of defects in asphalt pavements which are almost entirely under the control of the municipal engineer," and adds: "It is entirely unfair to the municipality, the tax payer and the contractor for the municipal engineer through ignorance or neglect to permit conditions to exist, either during the construction or after the street has been completed, that will permanently impair the usefulness or appearance of the thoroughfare." This is sound advice from one who has closely watched the evils of the high pressure flushing system of street cleaning; but what heed does the city or Chicago pay to its and some other cities' technical advisers? In the current number of another engineering journal we find a half page photograph of "one of Chicago's forty-one new flushing machines," forcing water, from about one foot above it, under pressure, on the surface of the pavement. Is it any wonder that contractors and surety companies in Chicago and elsewhere are repudiating their guarantees, as shown by an able paper in 1907 by John W. Hittell, Chicago's chief engineer of highways, before the American Society of Municipal Improvements?

The writer and others who have had long experience with construction and maintenance of pavements, have condemned this injurious system of street cleaning, which ruins pavements of all kinds, fills sewers with street dirt, consumes an excessive portion of water supply and is otherwise not economical.

A recent test of cleaning by high pressure flushing system, in New York City, shows as reported:

(a) Cost 72 cents per 1,000 sq. yds. per cleaning, for labor and water.

(b) Two gallons of water consumed per sq. yd. of pavement cleaned.

(c) Cost of water, 9 cents per 1,000 gallons.

At this rate in a city having 200 miles, say 4,000,000 sq. yds. of pavement, cleaned daily (Sundays excepted), say 300 times per year, the cost would be $2,880 per day, or $864,000 per year.

The water consumption figures 8,000,000 gallons per day, at 9 cents per 1,000 gallons, equals $720 per day, or $216,000 per year, or about approximately the cost of water supply of a city of 50,000 population. Knowing that the water used in flushing carries to the sewers at least 10 per cent of its bulk of street dirt and large portion of the dirt settles in the sewers, we see the great additional cost of sewer cleaning.

Every engineer, or official, and every periodical which is interested in construction and maintenance of street pavements, should persistently and at all possible times and places raise their voices in loud acclamation against this system of pavement ruination.

On this subject I quote the following from the *St. Louis Daily News* of May 20:

Present Method of Flushing the City's Streets Detrimental to Their Proper Maintenance—Volume of Water Employed Is Excessive—Unnecessary Expense to Tax Payer.

From more than one source have lately reached the *Daily News* complaints—which would seem to be justified—with regard to the system of flushing the city's streets.

"No one can have failed to notice the tremendous force with which the water is projected from the flushing machine employed in cleaning our streets, a force sufficient to drive the sand and soil from between the interstices of the granite blocks with which some of the streets are paved and to work serious damage to those artificially constructed asphalt or bituminous surfaces. The result has been that repairs to the streets become necessary much more frequently than is at all necessary or than would be the case if a more natural system of cleaning were employed.

Nor is this all. The volume of water consumed in street cleaning operations at the present time is excessive, and is also a source of unnecessary expense to the long-suffering public. So great, indeed, is the flow of water sewerwards down the gutters when the "flushers" are at work that few can get off the sidewalk without wading. With this stream goes not only all the street refuse but also much of the paving materials.

During the past year the street department has curtailed the use of flushing machines and the improvement in the condition of the pavements is marked.

Interviewed by a *News* reporter the

street commissioner, Mr. Travilla, admitted that these flushing machines now in use, if employed too frequently, damage asphalt or bituminous paving. The damage to brick, granite and wood pavements is also great, causing the joints to be opened, the pavements to be loosened and steadily dislocated, uneven and need excessive repairs.

Constant patrol hand sweeping, with occasional machine sweeping and light sprinkling just before sweeping, to allay dust, has been demonstrated to be the most economical, satisfactory and efficient method, not only for preserving pavements but especially for keeping streets constantly clean at all times of day.

J. W. HOWARD.
Consulting Engineer, Roads, Streets, Pavements, New York City.

It may be added that the city of St. Louis is reported to have rejected all bids for cleaning streets by flushing for the ensuing year.

SEWERS AND GARBAGE

St. Louis Sewer Specifications—Somerville Refuse

Specifications for Sewer Construction in St. Louis.

BY H. R. FARDWELL, SEWER COMMISSIONER.

At the convention of the American Society of Engineering Contractors held in St. Louis, Sept. 26, 27 and 28, Sewer Commissioner Fardwell of that city presented a paper on "Sewers and Sewer Construction in St. Louis," too late to be given in full in this number of MUNICIPAL ENGINEERING. The following discusion of certain difficult points in the specifications is abstracted and other parts of the paper will be given later:

Some of the main points in the specifications that might be discussed by the contractor and engineer are the specifications for concrete and the different classes of excavation, giving special attention to rock excavation.

In all the specifications at the present time under which our work is being carried on, there are two classifications of excavation, viz.: Class "A" and Class "B." Class "A" is solid rock, including detached pieces of rock or boulders one cubic yard or more in contents, and all masses of solid, well-defined ledges of stone or masses of rock. Class "B" includes all other materials encountered. In my opinion, a better classification might be had, provided the engineer and contractor could reach some understanding as to the method of bidding, which neither would vary from.

In the above classification, Class "B" material may be either earth, macadam, shale, fire clay, gumbo, or cinders with various kinds of rubbish dumped in excavations on the street. It is an undoubted fact that shale, fire clay and gumbo will cost more to excavate than good top soil or clay; it is also known that the concrete on the top of streets and macadam cost more to excavate than earth, but under this classification, the contractor is required to make a bid on anything that may be encountered, so that it is necessary that he either take a chance on these materials or make his bid sufficiently high so as to take care of them. In case he does encounter them and has not made his bid to cover the same, he loses money; in case he does make his bid sufficiently high and does not encounter these materials, the city loses money. The city, however, in trying to minimize this difficulty, has, in some of the districts, used core boring machines and given to the contractor a continuous core at certain definite points. These cores were on exhibition in the office of the Sewer Commissioner and were to be seen on application. In districts where core borings were not made, a punch rod, with a spoon, was used, and samples were taken every five feet of depth; this, of course, does not give as good an idea of the condition of the ground as core borings.

Incidentally, as a matter of interest from personal observation, it might be stated that some of our contractors do very little more than walk over the site of the work. In one of our particular contracts we had core borings made to show the nature of the limestone and the kinds of material above the limestone, so that the contractors might know the exact condition of the ground at various places, and out of twelve or fifteen contractors that took out plans for this work, only two looked at these core borings; still, they put in bids.

Core borings, as well as the punching rod method of testing the ground, are expensive. If there were some means whereby it would not be necessary to do core boring, to any great extent at least, or test the ground by means of punching rods, the city would save not only on the excavation but also the money spent for preparing estimates. The necessity for doing this preliminary work would be lessened if the classification was enlarged, thereby giving the contractor the means of

securing pay for the different materials encountered in his work.

Some of the contractors seems to think the old specifications for sewer work are better. Itn hese specifications, the classifications for excavation were Class "A", Class "B" and Quicksand. One of the main reasons for discontinuing the use of these classifications is in the Class "B"—loose rock. The old specifications read as follows: "Class 'B' shall include all stone, boulders and detached pieces of rock lying in separate masses more than three cubic feet and less than one cubic yard in size; also all slate, shale, soapstone, cemented gravel, coarse boulders in gravel, hardpan, or similar substances." This, in our estimation, was entirely too open, as the contractor could make a claim on any kind of material and get more classification than was intended. This particular paragraph could be approved, however, if the words "similar substances" were left out and there was any method of determining the exact number of the classes of material encountered. This latter, of course, is practically impossible to do. The final estimate would not carry the same number of yards of the various classifications that were preliminarily estimated, upon which the contractor had to bid. This gives the contractor an opportunity to bid more than any one classification should cost, provided he thinks it is underestimated, thus introducing the gambling element which should be eliminated at all times from all contracts. Undoubtedly, some method should be established for limiting the price of excavation and rejecting the bids when the contractor exceeds this price. As it is now, the lowest bidder, to whom work is awarded, is not necessarily the one whose prices are lowest when the final estimate is made out. In all probability, the method of reaching this result might be obtained by taking one of the classifications as a base and fix the ratio for the other classifications, and if this ratio is exceeded, all bids to be declared unbalanced are rejected.

Another source of trouble, both to the engineer and the contractor, is the limiting lines to which the contractor will be paid for rock excavation. Some contractors claim that it is impossible to drill holes and shoot rock to any prescribed line; this, of course, is a well-known fact. They claim that instead of making an absolute limiting line to which they will be paid, the specifications should read that they shall shoot as closely as possible to these lines; then comes the difficult interpretation of "as near as possible." Some contractors would, in all probability, drill deeper holes and load them with larger charges than they should. The only way that this can be overcome would be for the engineer to have absolute charge as to the method of doing the work. This, of course, is never given, neither should it be. On account of the fact that it is not best to give the engineer entire charge of the method of doing the work, it was thought best that limiting lines should be given to which excavation would be paid, regardless of where the rock might break to, and in case it broke beyond these lines, the contractor would be required to refill the cavities thus created, with concrete or other material satisfactory to the engineer in charge, at his own expense.

CONCRETE.

About five years ago, reinforced concrete sewer construction was introduced in St. Louis. At the present time, there is a large amount of this work under contract, and the specifications have undergone considerable change since this work was begun.

Following are the specifications governing the materials and the method of mixing and placing concrete, at this time.

The specifications for cement are those of the American Society of Civil Engineers.

Gravel or Broken Stone for Concrete.—All stone for concrete shall be hard limestone or washed gravel. The stone must be quarried from ledges and have a specific gravity of not less than 2.60. Any stone which shows a tendency to break into flat, thin pieces, will be rejected.

Broken stone and washed gravel must be free from dust, earth and other foreign materials. The grading of the stone or gravel shall be such that 100 per cent will pass a ring 1½ inches in diameter; not more than 70 per cent. nor less than 50 per cent. will pass a ring 1⅛ inches in diameter; not more than 40 per cent. nor less than 30 per cent. will pass a ring ⅝ inch in diameter; and not more than 5 per cent. will pass a ring ¼ inch in diameter.

After the broken stone or washed gravel has been graded to meet the above requirements, the voids will be calculated in the following manner: Broken stone or washed gravel shall be shoveled loosely, without compacting, into a box of known capacity, and shall be struck with a straight edge level with the top of the box. The actual volume of the broken stone or gravel shall then be determined.

The following expression represents the percentage of voids in the mass under consideration: Volume of box minus volume of broken stone or washed gravel divided by the volume of the box.

Concrete.—Concrete shall be composed of cement, sand and broken stone or gravel, and divided into Class "A," Class "B" and Class "C."

Mortar for Class "A" concrete shall have the ratio of 1 barrel of cement to 7.6 cubic feet of sand. Mortar for Class "B" concrete shall have the ratio of 1 barrel of cement to 11.4 cubic feet of sand. Mortar for Class "C" concrete shall have the ratio of 1 barrel of cement to 15.2 cubic feet of sand.

Concrete shall be made by mixing with the broken stone or gravel an amount of mortar of the proper class, which shall be 10 per cent. in excess of the voids in the stone or gravel.

Concrete of the class specified shall be used in such forms and dimensions as are shown on the plans or described in these specifications, and in such places as the Sewer Commission may direct.

Whenever an arch is turned or an invert or side wall is built, it shall be immediately covered with boards and kept

wet, in order that the concrete may be protected from the sun.

If a machine is used to mix concrete it shall be of an approved kind and one which measures the exact ingredients of each batch of concrete. Mixing shall continue until the face of every particle of stone or gravel is completely coated with mortar. The mixer shall be tested, and the batch of concrete, of the size that will give the best result will be used. The entire contents of one batch must be dumped at one time.

A continuous mixer in the operation of which the proportions of the ingredients depend upon the shovelers shall not be used.

Concrete may be mixed by hand if so directed by the Sewer Commissioner; provided, however, that suitable precautions are taken to insure accurate measuring and a thorough mixing of the ingredients. The concrete so mixed must be satisfactory in every way to the Sewer Commissioner.

Sufficient water shall be added to each batch of concrete to make it pass freely into the forms and around the reinforcement, but not enough to cause the gravity to separate the component parts.

Retempered concrete and concrete in which the initial set has begun shall not be used.

The surface of concrete in place and already set shall be roughened, cleansed and coated with ½ inch of Class "A" mortar before the fresh concrete is deposited.

Concrete, after being mixed as above specified, shall not be subjected to a fall that will separate the component parts.

Concreting shall proceed continuously for the length of sewer under construction, so that there shall be no line of separation between the batches.

The method of tamping the concrete shall be such as to form a compact, artificial stone.

Water-tight forms of dressed lumber or metal plates shall be constructed, and the prices bid for the concrete shall include the cost of these forms.

Forms shall be set true to the lines designated, and shall be made firm and secure. They shall be satisfactory to the Sewer Commissioner, and remain in place as long as he deems necessary. The finished surface of the interior of the sewer shall be left smooth.

The principal difference between the specifications now in use and those that were originally used on some of the earlier work is in the grading of the rock or gravel. The rock and gravel were screened free from dust and other impurities, and graded in size from 1½ inches to ¼ inch, measured on the greatest dimension; not more than 10 per cent. of the ¼-inch stuff were allowed to be used. The various sizes were so graded that the voids, measured in loose heaps, should be between 40 per cent. and 50 per cent. These voids not being determined exactly, made it impossible to state the exact number of cubic feet of cement to be used per cubic yard of finished work; in fact, the specifications above written do not state what is desired with a positive degree of accuracy, but come more nearly describing what is desired than the old way.

As the results to be arrived at are dense concrete, which gives the strength for which the sewer was designed, it becomes necessary for the engineer to use extra precautions in securing enough cement in the mixture. This anxiety on the part of the engineer often results in friction on the work.

A better method in all probability than either of the specifications is to have specified the number of cubic feet of cement to the cubic yard of finished work for the various classes of concrete work which are to be used, and in this way all misunderstanding on the work will be eliminated and the contractor will know exactly what he is bidding on at the time he bid on the work.

The foregoing are some of the principal difficulties that arise in our work, and I am sure some of the contractors deem them trivial compared to some of the difficulties they encounter.

An engineer protects himself by some such general stipulation as this: "Any work not herein specified which may fairly be implied as included in this agreement, of which the engineer shall be the judge, shall be done by the contractor without extra charge." This, of course, covers a multitude of sins. I find but few contractors in St. Louis keeping such records and cost data as will enable them fully to protect themselves when submitting proposals for work. The so-called incidentals and contingencies that arise in the aggregate amount form quite a percentage of the total cost of work, and while most contractors realize in an indefinite way that these charges are to be taken care of, few of them really know what they should amount to.

Refuse Disposal in Somerville, Mass.

In Somerville, Massachusetts, the collection of ashes, garbage and other refuse materials is under the control of the Board of Health, and a competent superintendent is employed to take charge of the department. Ashes and non-combustible materials are deposited on city dumps and combustible materials are burned in an incinerating plant, except that clean paper, rags, bottles and other merchantable materials are sold at a profit.

The garbage is sold directly to farmers and others. The demand for the garbage exceeds the supply, and the city receives considerable pecuniary return from the same. The sale of garbage and merchantable refuse in 1909 yielded $8,649.76.

Health Laws of Ohio.

The Quarterly Bulletin of the Ohio State Board of Health for July-September, 1910, contains the health laws of the state and a full index thereof.

MUNICIPAL AND TECHNICAL LITERATURE

Books for Engineers.

Road Preservation and Dust Prevention. By William Pierson Judson, Consulting Engineer. Cloth, 144 pp., 16 illustrations. $1.50 net. Engineering News Publishing Co., New York.

In this small book the author has collected descriptions of the experiments in improving roads to fit them for the heavy new traffic of automobiles and the like and has drawn some conclusions as to materials and methods, subject, most of them, to change as our information in this comparatively new development in road building is extended. The methods of laying dust more or less permanently are also discussed.

Many of the processes and materials were first tested years ago, but were too expensive for general application at that time. But the greater wear on roads under the modern traffic has increased the expense of repair of the old roads until it has become cheaper in the long run to lay more expensive pavements in first cost, that the repair bills may be diminished. The result is greater economy, but, undoubtedly, greater cost if the totals of first cost and maintenance under the former and the modern methods of construction are compared. Naturally the cost would be greater, the traffic being heavier as well as more wearing upon the roads, not to speak of the greater demands for comfort and convenience, as affected by surface, drainage, grades, bridges, and dustless wearing surface.

The problem is stated in general terms in the first chapter. This is followed by sections on dust prevention by moisture, including water and chemicals, by oil emulsions, oils and coal tar preparations. Then come descriptions of tar macadam, rock asphalt macadam and bitulithic pavements as progressive steps to the best road surface, the cost increasing with the improvement in quality.

For a general view of the field with illustrated descriptions of the machinery and methods in successful use, the book will be found satisfactory.

Dustless Roads, Tar Macadam. A practical treatise for engineers, surveyors and others. By J. Walker Smith, city engineer of Edinburgh and late borough engineer of Barrow in Furness. Cloth, 225 pp., with tables, $3.50 net. J. B. Lippincott Company, Philadelphia, Pa.

The author is an English engineer who has had much experience in the use of tar in tar macadam pavements and in spraying roads, and he has prepared a thorough book giving the results of English practice and much instruction upon the details of materials, methods and results. This statement of the results of the years of English experience in the reduction of the dust nuisance and the meeting of the necessity for economical improvement of road surfaces to meet the demands of modern motor vehicle traffic should be of very great value to American engineers working upon the same problems with the same materials under conditions similar except as to variations of climate.

The first chapter states the problem and shows the necessity for standardizing methods and materials. The second chapter gives a very full and valuable discussion of all the varieties of tar and the methods of treating them, with the difficulties met. The improbability of a tar famine is quite clearly shown by arguments based on statistics which can be duplicated very nearly in this country. This chapter and the next two reduce the materials of tar macadam pavements to standards.

Methods of laying the various kinds of tar macadam are quite fully described and illustrated by plans of plants, machinery, etc., in five chapters. Then follow discussions of such details as wear, porosity, density, crown, gradient, cleaning, watering, repair, maintenance, etc., showing the extent of the author's experience and the value of his advice. Tractive efforts on various kinds of macadam are compared in one chapter.

The author has collected much information from official reports and from individual officials, which he classifies and analyzes, with much intelligence and resultant value.

The methods and results of tar spraying of existing roads and the limitations of the method are briefly but clearly set out in one chapter.

Every engineer interested in this class of construction should study this book carefully.

The Health of the City. By Hollis Godfrey. Cloth, 372 pp., $1 net. Houghton, Mifflin Company, Boston, Mass.

Much of the material in this volume has appeared from time to time in the *Atlantic Monthly*, and it gives an excellent statement in non-technical English of what is known about the effect of impurity in air, milk supply, the city's food, the preparation of food, city water, ice, sewerage and plumbing, to each of which a chapter is devoted. City noises and their regulation, city housing abroad and at home are also considered. A brief bibliography closes the book.

The author is safe and sane and is as

definite in his treatment of the subject and his statement of conclusions as the limitations of his method permit. It should prove an excellent book for the health or sanitary officer in his efforts to lighten his labors by educating the people he is trying to serve.

The New Building Estimator. A practical guide to estimating the cost of labor and material in building construction from excavation to finish, with various practical examples of work presented in detail and with labor figured chiefly in hours and quantities. A handbook for architects, builders, contractors, appraisers, engineers, superintendents and draftsmen. By William Arthur. Cloth, 477 pp., plates and index, $2.50. David Williams Company, New York.

The second edition of this book was received last year and the appearance of this third edition so promptly is evidence that the book meets a large demand.

This edition contains all the material of the second edition, a few additions to several chapters and about 60 pages of new material in added chapters. Some of the new tables give radiating surface of steam pipes, areas of plastering in various sized rooms, comparisons of hand and machine work, etc. A new chapter goes into detail in estimating cost of reinforced concrete for foundations, walls, columns, floors, slabs, beams, etc., and of complete buildings of various methods of construction. There are also estimates of various patented forms of details. This adds materially to the value of an already very convenient book.

Dust Preventives and Road Binders. By Prevost Hubbard, assistant chemist, Office of Public Roads, U. S. Department of Agriculture; secretary of the committee on road materials, American Society for Testing Materials. Cloth, 416 pp., $3 net. John Wiley & Sons, New York, N. Y.

The development of the treatment of macadam roads to prevent dust and reduce wear has advanced sufficiently to warrant such a book as this, which is a careful effort to classify the methods and materials which have been tested and show their fields of application and suggest the best methods of use. The discussion is rather from the theoretical side, but is given a practical turn by the large experience of the author in the testing of materials and the observation of their action when used in actual construction both for purposes of comparative tests and in the regular line of road improvement.

The necessities of dust prevention, and the desirability of road preservation, particularly under the new demands of automobile traffic, are shown in the first chapter and then the author attacks his materials, first classifying them as temporary, semi-permanent and permanent binders and then according to their constitution and chemical characteristics. Subsequent chapters take up the inorganic dust preventives and binders such as water, sea water, bitumen, calcium chloride, sodium silicate, rock dust, etc., and hydraulic cements; the organic non-bituminous substances used for the same purposes, such as vegetable and animal oils and fats, waste sulphite liquor, molasses residues, rosin and resinates; and the hydro-carbons, which are fully classified and discussed as to details of chemical structure. The bituminous materials are also classified closely after Richardson's system, using only those which have shown promise as materials for treating roads as distinguished from pavements, viz.: petroleum and its products, semi-solid and solid native bitumens. Methods of application of the materials are given in full detail, providing a historical review of the development of the use of each. The chapters treat of petroleum and asphalt, tar and tar products in the treatment of roads already built; and to the application of tar and the construction of bituminous macadams according to various processes.

The chapters on examination of bituminous road materials and interpretations of results are full and comprehensive. One of them gives a full account of the methods which have been developed in the Government laboratory, and one of those proposed or adopted by the American Societies for Testing Materials and of Civil Engineers. These are supplemented by a valuable chapter on the selection of materials for particular uses and conditions, which contains specifications for road tar and oil.

At this stage of the progress of the art of road building this book forms a foundation for a thorough knowledge of the subject and, when supplemented by books devoted to the practical construction, will show the reasons for certain methods of procedure and for the failures of others and the probabilities of success or failure of almost any proposed method.

The Hindrances to Good Citizenship. By James Bryce. Yale lectures on the responsibilities of citizenship. Cloth, 134 pp., $1.25. Yale University Press, New York City.

The author of this book is qualified by long years of observation and experience in positions with the greatest opportunities for securing broad views of political subjects, to ascertain and state the governing conditions of our modern civic life. He has certainly succeeded in putting clearly before the reader the defects in the conduct of individuals which have resulted in our municipal troubles, and it only remains for the individual to make application of the principles developed to insure that he has done his full share toward the betterment of conditions. If every citizen should read the book and act according to its precepts, our civic troubles would shortly disappear in very large part.

The author names three hindrances to good citizenship, indolence, self-interest and party spirit, the first of which he terms the most common, the second the

most noxious, and the third the most excusable but most likely to affect the politicians, to which class most voters have belonged until very recent years, since the first has got in its full influence. These cover the ground, and there remains only the removal of the ignorance of the principles of self-government and of the methods of applying these principles to bring into existence the perfect city. With indolence changed to interest and study begun, with self-interest convinced that it best serves itself by conserving the interests of all, the upward movement will begin. Party spirit, modified by individual knowledge of right principles, more widely spread through the process of education, will more nearly insure progress in the right direction, for each party being actuated by high motives, the party differences will be due to the variations in opinions upon the best method of procedure, and intelligent party spirit will lead to more thorough consideration of problems. It should also lead to changes in line up as the problems to be solved change, for intelligent party spirit will not maintain a party after its problems have been solved, but will form new parties to attack new problems.

The author discusses the live problems of this country impersonally and under cover of other countries and yet so clearly that he cannot be misunderstood, at the same time that he follows strictly the letter of precedent and courtesy and disarms all criticism regarding the expression of opinion upon local questions by the representative from another nation.

ORGANIZATIONS AND INDIVIDUALS

American Society of Municipal Improvements — Engineering Contractors—Engineer Draftsmen—Central States Water Convention—Philadelphia City Club—Technical Organizations—Technical Schools—Civil Service—Personal Notes

The American Society of Municipal Improvements.

The seventeenth annual convention of the American Society of Municipal Improvements will be held in Erie, Pa., October 11, 12, 13 and 14 at the Chamber of Commerce rooms in the Reed Hotel.

The preliminary program has been issued and indicates sessions of more than usual value. It includes the following papers and committee reports:

At the afternoon session of October 11—Report of the committee on Sewerage and sanitation, by George C. Whipple, consulting sanitary engineer, New York, chairman; "Present Use of the Septic Tank," by H. N. Ogden, professor of sanitary engineering, Cornell University; "Municipal Sanitation in Cuba," by R. Winthrop Pratt, engineer, Ohio State Board of Health; "Construction of Exposed Sewers at Leavenworth, Kan.," by Joseph O'Neil, city engineer of Leavenworth; report of committee on disposition of garbage and street cleaning, Louis L. Tribus, consulting engineer, New York, chairman.

At the evening session of October 11—"European Sewage Disposal Works," illustrated by lantern, by Rudolph Hering, consulting engineer, New York; report of the committee on water works and water supply, by J. Walter Ackerman, superintendent of water works, Auburn, N. Y., chairman; "Improvements in Check Valves on Auxiliary Supplies," by J. Walter Ackerman; report of committee on park development and maintenance, by A. M. Reynolds, chief engineer Essex County, N. J., Park Commission, chairman; paper by F. L. Olmstead, landscape architect, Brookline, Mass.; paper by H. S. Richards, assistant superintendent of South Park Commission, Chicago, Ill.

At the morning session of October 12—Report of committee on street paving, by Wm. A. Howell, engineer, street department, Newark, N. J., chairman; "Modern Stone Block Pavements," by Wm. A. Howell; "Bituminous Pavements, Patented and Otherwise," by E. A. Kingsley, superintendent of public works, Little Rock, Ark.; report of committee on Standard specifications, C. H. Rust, city engineer, Toronto, Canada, chairman; report of sub-committee on asphalt pavements, by A. W. Dow, consulting chemist, New York; report of sub-committee on brick paving, by E. H. Christ, Grand Rapids, Mich.; report of sub-committee on bituminous paving nomenclature, by W. W. Crosby, state highway engineer of Maryland, Baltimore, Md.; report of committee on street lighting, by E. A. Fisher, city engineer, Rochester, N. Y., chairman; report of committee on fire protection, by

Alcide Chausse, city architect and superintendent of buildings, Montreal, Canada, chairman.

During the afternoon of October 12 a boat ride on Presque Isle bay to points of interest and a fish fry at the Country Club.

At the evening session of October 12—Discussion of questions and topics. Among those submitted are the following: Catch basins; when should they be used and when simple inlets only? What can the society do to increase its value to its members, especially those who cannot attend the conventions? Standard specifications for curbs, gutters and street crossings.

At the morning session of October 13—Report of committee on municipal data and statistics, by Ernest McCullough, editor *Railway Age Gazette*, Evanston, Ill., chairman; "The Census Bureau's Municipal Statistics," by A. Prescott Folwell, New York; report of committee on taxation and assessment, by A. M. Heston, city comptroller, Atlantic City, N. J., chairman; "Taxation," by A. M. Heston; report of committee on municipal franchises, by Charles Carroll Brown, editor MUNICIPAL ENGINEERING, Indianapolis, Ind., chairman; report of committee on city government and legislation, by S. A. Freshney, secretary and general manager board of public works, Grand Rapids, Mich., chairman; report of committee on review, by C. D. Pollock, acting chief engineer, bureau of highways, Manhattan, New York, chairman.

Erie is laid out on the rectangular plan. East and west streets are numbered, beginning at the lake front. The main street is State street, which passes through the center of Central Park, which lies between Fifth and Seventh streets. On this park face most of the principal buildings, including the city hall, the court house, the post office and two of the principal hotels, the Reed House—headquarters of the society—and Park View Hotel. The Union Depot is at the corner of Fifteenth street and Peach street, which is one block west of State.

Erie was settled in 1795 and has a present population of about 68,000.

There are 110 miles of streets, of which 51.14 are paved, over one-half of the paving being asphalt, about one-third brick, with small amounts of stone block and creosoted wood block.

There are about 90 miles of sewers, largely on the combined system.

In connection with the water supply, which is taken from Lake Erie, the city has recently completed an intake extending across the bay and peninsula, and is now completing the construction of settling basins.

The streets are lighted with 692 arc lamps by a private corporation, which charges 18 cents per light per night; also by 548 Welsbach lamps at 5½ cents per light per night.

There will be the usual exhibits and the arrangements for entertainment of delegates and ladies, and for inspections of matters of interest to engineers and municipal officials, in addition to those named above, are ample. The sessions will continue until noon of Friday, in order to give time for the discussions which are always of great interest.

Ben E. Briggs, city engineer, is a vice-president of the society and is in charge of the local arrangements, and will give any information about details that may be desired.

One of the most important subjects of discussion will be that of standard specifications. The general committee has a report on the program, and several of the special committees on specifications for pavements also have report to make.

The Convention of the Central States Water Works Association.

The fourteenth annual convention of the Central States Water Works Association was held in the Claypool Hotel, Indianapolis, Ind., on September 20, 21 and 22. The following papers were presented and discussed at these meetings:

"Notes of Experience of Some Tests of Pipe," by Mr. W. R. Conard, consulting engineer, Burlington, N. J. A brief abstract of this paper is given elsewhere in this issue.

"The Acid Water of Western Pennsylvania," by E. C. Trax, McKeesport, Pa. Mr. Trax called attention to the extreme acidity of the Allegheny, the Monongahela and the Youghiogheny rivers. This condition is due to the oxidation of iron pyrites common to the region and to the wastes from coal washers and other mining utilities. The acid is so strong at times as to kill fish in the streams named; and in McKeesport previous to the installation of a water softening plant the waste of water through services damaged by acid was about 50 per cent. Conditions are particularly bad at the time of low water. The two possible remedies proposed are the enforcing of purification laws or the reforestation of lands forming the watersheds, so as to guard against the extreme low water.

"The Obligation of Water Works Superintendents with Respect to the Sanitary Quality of Public Water Supplies," by Paul Hansen, state sanitary engineer of Kentucky, is self-descriptive as to subject matter. Mr. Hansen dwelt particularly on the need of adequate purification provisions and competent handling of such. He stated that the prime duty of a superintendent is to give a safe supply; an economical supply should be a secondary consideration.

"Repairing a Sixteen-inch Main," by Mr. C. W. Wiles, Delaware, Ohio, told of the trouble experienced in repairing a main with a 36-inch 900-lb. sleeve, when, owing to leaky valves, the pressure could not be shut off.

"Clean Water as a Municipal Asset," by

George C. Whipple, consulting engineer, New York City, was an interesting discussion of the water purification question. He dwelt on the fact that people demand a clean water with a good taste, as well as one that is chemically pure and safe. Bacteriological as well as chemical tests are to be desired. Mr. Whipple states that the calcium hypochlorite method of purification is not entirely adequate. It destroys the B. coli and B. typhi germs, but does not completely disinfect, and will not destroy spore-forming bacteria. The quality used is not enough for oxidation, it adds to the odor and does not improve the taste. It should be used as an adjunct to filtration, as it sometimes enables a higher degree of filtration. It should never be regarded as a purification agent complete in itself, and there is danger through faulty application. In the last portion of his paper Mr. Whipple calls attention to the various factors to be met with in a filtration system, and emphasizes the need of different methods to fit the case at hand. Over-emphasis is often given to stream purification by means of sewage treatment, when the same or better results may be obtained and often at a less cost by purifying the water used. Mr. Whipple recommends the establishing of water softening plants where the hardness exceeds 250 parts per million, and sometimes a little less degree of hardness makes the plant a good business venture. In closing he calls attention to the increasing recognition of the need of abundant clear water and mentions Louisville and Cincinnati as first in the field of mechanical filtration, and Columbus as first with a practicable water softener.

"The Steam Turbine Centrifugal Pump," by C. W. Hurd, of Indianapolis, gives a comparison of the turbine-driven centrifugal pump with the vertical triple expansion type. Mr. Hurd bases his comparison on a 10,000,000 gallon supply pumped against a 200-foot head, with coal fired at $2.50 per ton. The vertical triple expansion type, including boiler equipment, costs $180,000. Computing interest, depreciation, etc., at 9 per cent., the yearly fixed charge is $16,200, or $4.33 per million gallons. By comparison a turbine-driven centrifugal pump of same capacity costs, complete, $90,000. Using the same basis of computation the annual fixed charge is $2.16 per million gallons. Assuming labor, maintenance, etc., to cost the same for either type, the centrifugal type costs $8,100 per year less than the high duty. But the high duty may be operated for about $7,300 per year less than the cheaper type of unit. This makes the saving on the centrifugal type about $800 per year or 21 cents per million gallons cheaper than the high duty equipment. Mr. Hurd recommends the high duty equipment for large plants requiring steady operation, but for the smaller plants under intermittent use the turbine-driven centrifugal is advocated.

"The Business End of a Water Company," by C. E. Inman, of Warren, Ohio, advocated courtesy as a business asset of a water company.

"Floods, Conservation and Their Relation to Water Supply," by Morris Knowles, C. E., is a broad and comprehensive discussion of this much-talked-of subject.

Michigan was added to the list of states represented, so that now the association is made up from Illinois, Indiana, Kentucky, Ohio, West Virginia, Pennsylvania, Missouri, Wisconsin and Michigan. The following officers were elected without opposition: President, A. L. Holmes, Grand Rapids, Mich.; vice president, W. J. Scroggins, Wheeling, W. Va.; secretary, W. A. Veach, Newark, O.; treasurer, A. W. Inman, Massillon, Ohio. Cleveland, Ohio, was chosen as the place of meeting in September, 1911.

American Society of Engineering Contractors.

The first annual convention of the American Society of Engineering Contractors is in session in St. Louis as this number of MUNICIPAL ENGINEERING goes to press. The program includes address of welcome and responses, a paper by Edward Wegmann and J. B. Goldsborough on "The Construction of the New Croton Dam," one by H. R. Fardwell, sewer commissioner, on "Sewers and Sewer Construction in St. Louis," and one by Geo. C. Warren on "Work Preliminary to Road Construction and Street Pavement Maintenance." The last two are given in whole or in part elsewhere in this number. A banquet was held on Tuesday evening, and the committees on uniform specifications, contracts, cost-keeping and analysis made progress reports.

Much time was spent in trips to see the new sewers, which are the largest in the world, the water works and other objects of engineering interest.

The American Society of Engineer Draftsmen.

On June 18 the first steps were taken to form a permanent organization to be known as the American Society of Engineer Draftsmen, embracing every branch of the profession, including mechanical, electrical, civil, architectural, marine, sanitary, automobile and aeronautical draftsmen. The first meeting of the society was held on July 27. The formation of this organization, which was conceived by E. Farrington Chandler, a well-known designer and inventor, marks the first effort to form a national society among draftsmen.

The officers chosen are E. Farrington Chandler, president; William B. Harsel, vice-president, and Henry L. Soan, secretary and treasurer, with headquarters at 116 Nassau street, New York.

The City Club of Philadelphia.

The City Club Bulletin for September 22 gives the program for the following season, two programs for each month. The first three programs are devoted to health matters, pure milk supply, a clean city, and the health activities of various city departments; three to safety, protection of citizens in the street, in other places, and protection of property; one to provisions for convenience; three to education, in schools, for efficiency in daily occupations to cultivate civic intelligence outside of schools; three to prosperity, in affording citizens opportunities to earn a living, in providing transportation by land, and by water; one to the efforts to promote philanthropy, and one to the city plan. The plan of each meeting states the functions that must be performed, the public and private agencies which must perform them, including the public service corporations when any are involved, and their performances and duties.

The club publishes a weekly bulletin which gives quite fully reports of the results of its activities as well as its needs and desires for the future.

Technical Organizations.

The annual convention of the American Street and Interurban Railway Association will be held at Atlantic City, N. J., October 10, 11, 12, 13 and 14. H. C. Donecker, sec'y., 29 West Thirty-ninth street, New York City.

The annual meeting of the American Gas Institute will be held at New York City, October 19, 20 and 21. A. B. Beadle, sec'y., 29 West Thirty-ninth street, New York City.

The annual convention of the Illuminating Engineering Society will be held at Baltimore, Md., October 24. P. S. Millar, sec'y., 29 West Thirty-ninth street, New York City.

The National Land and Irrigation Exposition will be held in Pittsburg, Pa., in October. This offers the clay interests an opportunity to promote the increased use of drain tile.

The International Prison Congress was held in Indianapolis, September 26 to 30.

The thirty-eighth annual meeting of the American Public Health Association was held at Milwaukee, Wis., September 5, 6, 7, 8 and 9. Among the papers presented were the following: "Organization for the Protection of Health," by Dr. Walter Wyman, surgeon-general of the United States Public Health and Marine Hospital Service; "Research Work," H. W. Clark, Boston; "Executive Methods in Preventive Medicine," Dr. H. B. Hemenway, Evanston, Ill.; "The Relations Between State and Municipal Boards of Health," Dr. C. A. Harper, Madison, Wis.; "The Correlation of Physicians, Engineers and Other Experts, in Public Health Work," Prof. Wm. T. Sedwick, Massachusetts Institute of Technology; "Social Economics and Public Health," Hon. Emil Seidel, mayor of Milwaukee; "The Universities in Relation to Public Health Work," Dr. W. H. Hill, Minneapolis; "Water and Sewage Treatment," George A. Johnson, associate member Am. Soc. C. E., of Hering & Fuller, New York City; "Electrolytic Production of Sodium Hypochlorite," Charles P. Hoover, chemist water purification, Columbus, O.; "The Preservation of Sewage by Chloroform and Cold Storage," Dr. Arthur Lederer and Harry B. Hommon, of Sanitary District of Chicago; "Sanitation of Labor Camps," by Dr. Huber Pease, of New York City; "Garbage Collection and Disposal," by Dr. P. M. Hall, of Minneapolis; "Modern Practice in Garbage Disposal," Rudolph Hering, of New York City; "A Portable Hypochlorite Water Treatment Plant for Emergency Use," by H. A. Whittaker and J. A. Childs; "The Self-Purification of Streams as Affected by Changes of Season," Gustav F. Ruediger; "The Relation of the University to Public Health Work," by Dr. H. W. Hill; "The Relation of Dissolved Oxygen in Water to the Quality of the Water," Dr. Arthur Lederer. Officers were elected as follows: President, Dr. R. H. Simpson, Winnipeg, Can.; vice-presidents, Dr. Fernando Lopez, City of Mexico; Mr. John F. Anderson, Washington, D. C., and Dr. G. A. Bading, Milwaukee, Wis.; secretary, Dr. William C. Woodward, Washington, D. C. The officers of the three existing sections are as follows: (1) Laboratory—Chairman, Dr. John A. Amyot, Toronto, Can.; secretary, B. B. Rickards, Columbus, O. (2) Vital Statistics—Chairman, Dr. W. R. Batt, Harrisburg, Pa.; secretary, Dr. F. L. Watson. (3) Municipal Health Officers—Chairman, Dr. A. J. Douglass, Winnipeg, Can.; secretary, Dr. E. C. Levy, Richmond, Va. The next convention will be held at Havana, Cuba.

The Building Trades Employers' Association has announced a competition for designs for single or detached buildings. Full terms of the competition can be obtained by addressing the association at 34 West Thirty-third street, New York City. Designs must be submitted on or before December 1. Prizes in the first class are $100, $50 and $30, and in the second class are $150, $75 and $50 for first, second and third prizes, respectively.

At the meeting of the Municipal Engineers of the City of New York, held September 28, Samuel D. Dodge and William B. Hoke presented a paper on "Studies and Explorations for the Hudson River Crossing of the Catskill Aqueduct."

Technical Schools.

The University Bulletin for July, of the University of Michigan, Ann Arbor, Mich., is a book of 384 pages, containing the announcement of the Department of Engineering for 1910-11, with the courses of instruction, the register of students and the register of alumni.

The Ohio State University Bulletin for August 4 is commemorative and gives a history of the Department of Civil Engineering, biographies of officers, and a register of alumni.

"The Transit," an annual publication of the College of Applied Science of the Iowa State University, contains a detailed description of the Holland, Mich., electric light and power plant. The plant is municipally owned and operated through the board of public works.

Civil Service Examinations.

The United States Civil Service Commission will hold examinations at the usual places as follows:

For clerk-draftsman in surveyor-general's office at $4 a day, or $1,200 a year.

Personal Notes.

Mayor McGaughey, of Veedersburg, Ind., has tendered his resignation, to take effect October 1.

Kitchell M. Boorman, A. B., civil engineer, has opened an office as consulting engineer at 11 Cliff street, New York City.

M. J. Spillane has been appointed a member of the board of sewer commissioners, to succeed Dr. B. F. Chase, resigned.

Dr. B. F. Chase has resigned as a member of the board of sewer commissioners at East Syracuse, N. Y., of which he was president.

William Henry Lakie, district manager of the Barber Asphalt Paving Company, in New York State and Canada, died at Buffalo, N. Y., September 3, aged 39 years.

Mr. D. J. Hauer, of New York City, has recently been appointed eastern editor for the *Contractor*. He is now handling this work in connection with his concrete specialty business.

T. H. Gwynne, for many years manager of the Pittsburg Vitrified Brick Company's plant at Pittsburg, Kan., died recently at Khedive, Pa., where he had been for nearly a year.

J. C. Stevens, Assoc. M. Am. Soc. C. E., who resigned in July as district engineer, United States Geological Survey, at Portland, Ore., in charge of water resources work in the Pacific Northwest, has recently established an office for the practice of hydraulic engineering at 509 Beck building, Portland.

Richard P. Bannon, of Louisville, Ky., a director of the P. Bannon Sewer Pipe Company, and connected with the clay-working business for many years, died recently at his home in that city.

Morris Knowles, M. Am. Soc. C. E., until recently chief engineer of the Pittsburg Bureau of Filtration, has opened offices in the Oliver building, Pittsburg, for the practice of general civil engineering.

The Edmund T. Perkins Company have opened offices as engineers in the First National Bank Building, Chicago, Ill., and will devote their time to projects for the development of natural resources, irrigation in particular.

Jerome Cochran, Jun. Am. Soc. C. E., until recently a consulting engineer at Houston, Tex., has become designing engineer of the Corrugated Bar Company, of St. Louis, Mo., with offices in the National Bank of Commerce, at St. Louis.

Ira G. Hedrick, M. Am. Soc. C. E., and Victor H. Cochrane, Assoc. M. Am. Soc. C. E., have formed a partnership for the practice of consulting engineering under the firm name of Hedrick & Cochrane, with offices at 1118 McGee street, Kansas City, Mo.

Rupert K. Stockwell, Jun. Am. Soc. M. E., has resigned as construction engineer with the United Smelting, Refining & Mining Company of Salt Lake City, Utah, and has become assistant general superintendent for the Alpha Portland Cement Company at Easton, Pa.

Elwood Mead, M. Am. Soc. C. E., M. Inst. C. E., chairman of the water supply commission of the State of Victoria, Australia, is visiting in this country. Mr. Mead is accompanied by Hon. Hugh McKenzie, Victoria Minister for Lands, and the two constitute a land settlement commission, appointed by the State of Victoria to visit England and the United States for the purpose of securing settlers on land owned by the State. An effort will be made to induce settlers experienced in irrigation to go to Australia. The State is said to be putting water on relatively small holdings of land, and also building houses for the farmers. Mr. Mead will be remembered as having been state engineer of Wyoming, chief of irrigation and drainage investigation, United States Office of Experiment Stations, Department of Agriculture, and as a lecturer on irrigation institutions at the University of California for a number of years.

MACHINERY AND TRADE

A Test of Bitulithic Pavement.

Bitulithic pavement was given a unique test in York, Pa., recently, in the presence of the mayor of the city and several citizens interested in paving work. The test consisted of allowing a large traction engine of the A. B. Farquhar Company, of York, to pass over the pavement. The engine was a 15-h.p., weighing ten tons, and its wheels carried the customary cleats on the rear and the sharp center ridge on the rim of the front wheels. These ridges and cleats did not injure the surface of the pavement in the slightest degree. The only marks left were the dust and dirt marks that would be made by any broad wheel passing over a newly paved street.

In addition to this, workmen in the employ of the Standard Bitulithic Paving Company gave a demonstration of the rapidity with which the paving can be repaired, by cutting out a number of sections and replacing them.

A Practical Application of Wireless Telegraph Principles.

The careless manner in which pipes are laid and the fact that few of the older water systems carefully located or platted their pipes, has resulted in a condition of affairs where at times even water or gas mains are practically lost, and to one who has endeavored to find an old service pipe, the trouble is only too well known.

An instrument has recently been put on the market whereby these lost pipes can be easily located. The "wireless" principle upon which the instrument is constructed makes it very easily handled. It may be used to locate a pipe which may be buried beneath ten or fifteen feet of earth, snow, ice, concrete, boards, etc.

The apparatus consists of an instrument for producing an electric current on the pipe which is to be located, and a special head telephone receiver and detector coil, constructed to pick up the electric wave produced by the instrument, so that it can be distinctly heard in the receiver.

After connecting the instrument properly either inside or outside of the buildings, the operator can hear the tone in the receiver distinctly with the detector coil held in the hand. In this manner the exact location of the underground pipe can be followed as many feet, yards or blocks as is necessary.

The vibrating apparatus is mounted compactly in a box, with the six batteries necessary for operation. all self-contained within the case. This part is left connected as desired and does not need to be moved while locating pipe within the circuit.

The detection consists of a detector coil connected by a short length of wire to a receiver, carefully wound and adjusted to the vibrations of the sender. The detector coil is specially made for pipe location work, and is so constructed that it will pick up the tone as soon as brought within the influence of the current, the windings of the detector coil are such as to neutralize the current and kill the tone, thus giving a point of silence when the coil is directly over the pipe to be located. When this point is found, by passing the coil back and forth a few inches the exact location of the pipe can easily be determined.

The Modern Iron Works, of Quincy, Ill., manufacture the apparatus and will furnish full descriptive literature on application.

Durability of Bitulithic Pavement.

In the report of George A. Carpenter, city engineer of Pawtucket, R. I., attention is called to the excellent condition of the bitulithic streets in that city. There are 61,512 square yards of this pavement, laid in 1901, 1904, 1906 and 1908, and it is all in a fine state of preservation. There have been no repairs made on these streets, nor is there any apparent need of such at the present time, even on that pavement which has been in since 1901.

The Success Concrete Pipe Molds.

The three factors, experience, equipment and a determination to make a thoroughly practicable apparatus have resulted in the production of the "Success" concrete sewer pipe and drain tile mold. The "Success" consists of an outer shell of 12 gage steel, made in three sections (to facilitate removal without scraping the tile) and bound together at the bottom with channel steel. The top of the outer shell is bound with a T-steel band to which the cast bell for making sewer pipe is attached by means of cap screws. By this arrangement an ordinary drain tile, without the bell, may be made by simply removing the cap screws. This feature makes a combination mold of the device. The locking devices are simple in extreme; they are so constructed that there is no danger of injuring the tile in unlocking the shell, and are attached to the shell so that there are no parts to become lost or broken.

The core is made of a single piece of

No. 14 gage sheet steel and forms a cylinder with overlapping edges. The core is bound by rigid bands at top and bottom and is regulated by expansion levers which are self-locking so as to eliminate the danger from the core becoming loosened before the tile is finished. In making the bel end of sewer pipe, the casting which is termed the bell core and which forms the socket of the tile, is held in position by means of a set of small levers with hooks which lock underneath the top band of the core and which are easily released after the mold is filled, and which is the first part removed after the tile is made. The device for centering the core is so arranged that after tamping the first filling it is removed entirely out of the way.

The intention has been to construct a mold that would meet the requirements of the practical tile maker and one that could be relied upon to do all that is required of a first-class mold; one that after having made the tile, could be removed from it without disastrous results, and constructed in such a manner and of such material as would best withstand the hardships to which a mold is subject; one that requires no cast-iron pallets, using only board pallets, a good wood or cement floor on which to leave the finished tile; with a perfect arrangement for centering the core, and a core with sufficient expansion and contraction to insure its removal with most exacting results, and which requires no springs, lock nuts or locking device of any nature to hold it in place while the mold is being filled, with the bell made at the top where it can be tamped as thoroughly as the body of the tile.

For catalogues and prices of the "Success" molds and for costs of constructing tile with them write to Grob Brothers, Kendallville, Ind.

Good Roads.

The above title is applied to a handsome book issued by the Port Huron Engine and Thresher Co., of Port Huron, Mich. The book is more than a catalogue of Port Huron road making machinery, for it goes into the history, methods of building, and maintenance of good roads.

Part I, devoted to the history of road making, deals in general with the good roads question from 312 B. C. to 1910 A. D., with especial reference to the construction of macadam roads in Michigan.

Part II takes up the construction of roads from the quarrying of rock to the final rolling. Photographs of actual work are used throughout this part and in other parts as they are needed.

The question of cost is taken up in Part III, and particular care is shown in the comparison of horse and mule power with the more efficient steam power.

Parts IV and V are devoted to the Port Huron machinery in particular, dealing with the construction, operation and "past performances" of their road machines.

The book is especially well gotten up and illustrated in great detail. The tables of cost should be particularly valuable to one interested in good roads, their construction or renewal.

Buff Engineering Instruments.

The 1911 book of the Buff & Buff Mfg. Co., of Boston, is exceptionally well planned and executed. It comprises about 120 pages, printed on the best grade of heavy paper and illustrated throughout with halftones.

The first part of the book is taken up with a description of the points of particular value in the Buff instruments. The reasons and arguments for adopting the forms of construction used are given and a complete lilustration is given of each point discussed, with the methods employed in attaining their manufacture.

Following this department is one devoted to photographs of the instrument shops at Jamaica Plains Station, Boston. This section is of interest to one unacquainted with the process of manufacture of surveying or mathematical instruments.

The balance of the book is devoted to the description, specifications and photographs of transits, levels, planimeters, current meters and many other instruments manufactured by the company. The book is of educational value as well as being of interest to one intending the purchase of some of the instruments described.

A Cast-Iron Pipe Handbook.

"McWane's Handbook for Cast-Iron Pipe Users" is the title of a leather-bound pocket-size book, issued by the McWane Pipe Works of Lynchburg, Va. It is issued for the purpose of classifying, describing, and tabulating the line of cast-iron pipe and special castings made by the above mentioned company. No attempt has been made to give general information along the line of water and gas works construction further than to furnish a number of tables useful in hydraulic computations. These tables as well as the standard specifications for cast-iron water pipe, published in the fore part of the book, will be found of value. In connection with these specifications, tables of sizes, weights and dimensions of pipe are given for both the American Water Works Association and the New England Water Works Association standards.

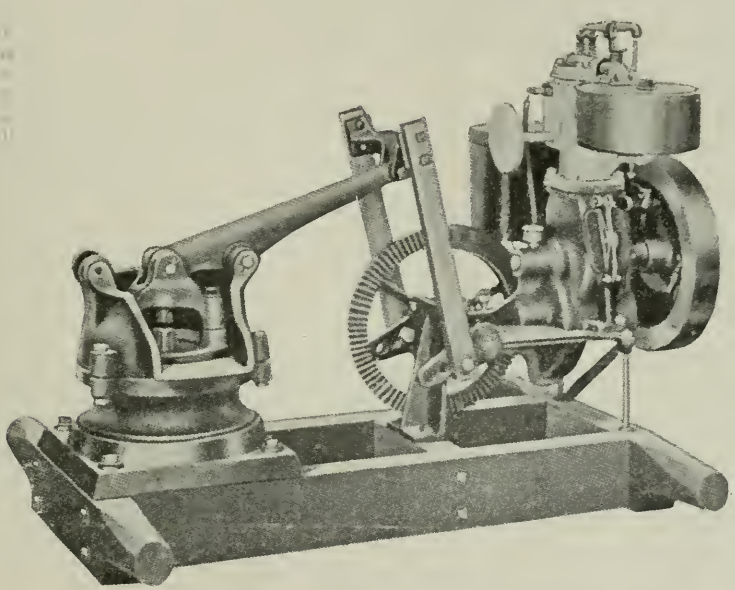
One table of "cost laying as determined by actual practice under varying conditions" is given. In this table items are made of the various factors such as pipe per foot, yarn per foot, lead per foot, trenching and refilling 4-foot cover, etc.

This is all of doubtful value as no reference is made to the class of excavation considered, the freight and hauling of materials and other items that would have a decided effect on the statement of unit cost offered to be used as a basis of comparison.

With this possible exception the handbook should be of value to one interested in cast-iron pipe work.

A New Diaphragm Power Pump.

The Fuller & Johnson Manufacturing Co., of Madison, Wis., have had a farm pumping engine on the market for a number of years. They are now manufacturing a diaphragm power pump operated by their well-known type of engine. The outfit is mounted on a substantial wooden frame and the pump is connected to the engine by a special type fulcrum lever so as to offer a maximum of power efficiency. The entire apparatus is light and may be easily moved about as required.



THE FULLER & JOHNSON DIAPHRAGM PUMP.

The engine is a one-cylinder gasoline type operating the pump at from 31 to 40 strokes per minute. It is capable of exerting a lift of 1,000 pounds on the lever and will easily handle a 4-in. suction diaphragm on a 20-in. lift. A feature of note in this engine is the arrangement of the batteries in a sheet steel battery case rigidly attached to the side of the crank case, so as to be well protected.

The pump is of standard design, with a rubber diaphragm which may easily be removed in case of wear. The suction valve and base check valve are also rubber faced, insuring good suction. Both bottom and side suction types are supplied, the former for use with pipe and the latter with a hose; either 3-in. or 4-in. suction pipes may be obtained. One good feature of the arrangement of the side suction type is the placing of the intake on the opposite side of the pump from the discharge.

The only attention or expense required to operate this power outfit is to supply the necessary gasoline and lubricating oil. A ten-hour continuous run will consume approximately 2 quarts of gasoline, or at a total expenditure of not over 12 to 15 cents. Compare this cost with the operation of a hand bilge pump. The ordinary price paid will average about $2 per day each for 2 men; then if a steady pumping is required through the night at least 2 more men are required at $4. This makes a total of $8 for labor each 24 hours as compared to 30 cents for power in the case of the power pump. In addition to the cost factor the steady operation and the fact that superintendence is unnecessary in the case of the power pump, makes the advantage of this type of pump plainly evident.

Butt Welded Pipe Joints.

As the continuous welded rail is largely superseding the old loose method of connecting rails by fish plates and copper bands in street railway tracks, so does the butt weld for pipe joints bid fair to displace the old type screw joints in pressure pipe work. The Thermit pipe weld-

ing apparatus is doing much to aid this tendency.

By means of this apparatus the pipe may be welded after being put in place in its permanent position. All the pipe welding materials are portable, nothing being used that one cannot carry with ease. The joint obtained is of greater strength than the pipe itself, assuring safety in all cases where a heavy pressure is exerted on the pipe.

The resistance of the welded joint to all sorts of heavy stress is illustrated by an accident at the Essen Works of Messrs. Th. Goldschmidt. In this case a 7½-ton air receiver fell across several welded joint compressed air and steam pipes. These lines, however, were not broken nor torn, and it was possible to continue using them, though they were bent entirely to the ground a distance of 15 feet vertically and about 25 feet feet horizontally between two buildings.

The Thermit apparatus may be used to weld pipes up to 4 inch double extra heavy. This largest sized pipe was used in a pipe line made for the New York Central Railroad at its West Albany shops, on a pipe line carrying hydraulic pressure to a boiler shop. Thermit welded joints were used and in a test of 3,000 pounds pressure not a single flaw was developed in a ten-hour test, though the working pressure was only specified at 1,500 pounds per square inch for this pipe.

For specific information regarding this apparatus, address the Goldschmidt Thermit Co., 90 West street, New York.

The Moore Patent Snow Plow.

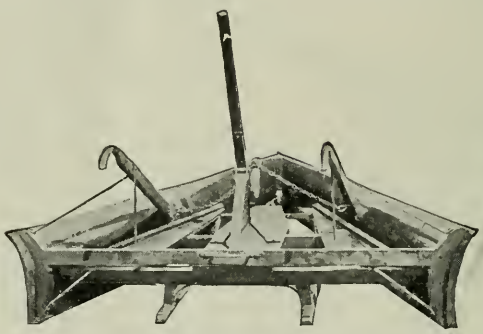
The Moore Specialty Manufacturing ing.
Company, of Detroit, Mich., has completed a factory devoted to the making of their patent snow plows. The great adaptability of the plow has made necessary this outlay for increased factory capacity, after three years of successful manufacture.

A reference to the accompanying photograph will indicate the points of particular merit in this plow. Seventeen strips of white pine, 2 inches by ⅞-inch, of the required length, are fastened together to form the concave mold boards, which by their design roll the snow away and prevent it from clogging, and thus dispense with the need of extra weight to hold the plow down. The mold boards are shod with the best steel and malleable iron.

By means of the lever shown at the center the operator may raise the plow so that it rests on the sled. This feature is of great value in transporting from place to place or in crossing curbs, ruts, side ditches, etc.

The plow is provided with either pole or shafts, which are hung on a swivel, making it easy to turn sharp curves. The excellence of design, insuring against clogging and the carrying of extra weight, makes it possible to operate the five or six-foot size through two or three feet of snow, with one horse.

The Moore special snow plows have a feature of adjustment that makes them of value for street or park work. A set screw adjustment is provided on the cross-bar so that the mold boards may be set to widths varying from six to eleven feet. By this arrangement the varying widths of park or cemetery drives may be taken care of. The Detroit Cemetery Association is using a Moore adjustable for their cemeteries and parks, because of its convenience, as their driveways and park drives vary considerably in width.



THE MOORE SNOW PLOW.

Full catalogues and prices may be obtained from the Moore Specialty Manufacturing Company, 601 Majestic building, Detroit, Mich.

Cement Statistics for 1909.

More cement was made and used in the United States in 1909 than in any preceding year, and the price per barrel was lower than ever before. The production in 1908 was 52,910,925 barrels, valued at $44,477,653; the production in 1909 was 64,196,386 barrels, valued at $51,232,979.

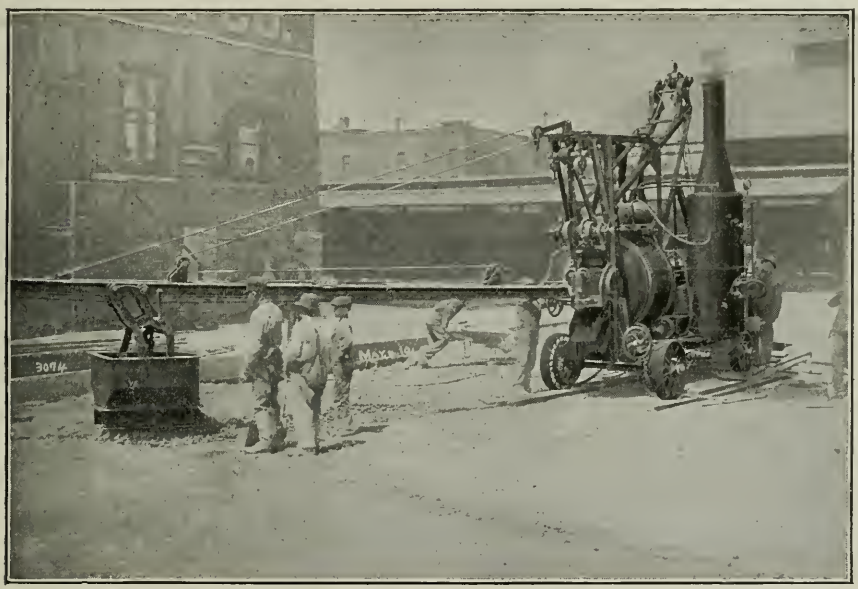
The increase was mainly in the output

of Portland cement—62,508,461 barrels, valued at $50,510,385, as against 51,072,-612 barrels in 1908, valued at $43,547,-679. The output of natural and puzzolan cement formed only a small percentage of the total cement production.

The average price of Portland cement per barrel in 1909 was less than 81 cents; the average price per barrel in 1908 was 85 cents. Portland cement cost $3 a barrel in 1880, but by reason of improvements in method of manufacture it can now be profitably sold for 80 cents a barrel.

In 1909 there were 103 Portland cement plants in operation, an increase of 5 over the number working in 1908. Of these plants 21 were in Pennsylvania, 12 in Michigan, 10 in Kansas, 8 in Ohio, 7 in New York, 6 in Indiana, 5 in Illinois, and 5 in California.

Most of this cement was used at home, for the United States has only a small export trade in cement, consuming from 1 to 3 per cent of the production. This country's immense natural resources of cement-making materials and its many well-equipped cement plants, however, should make it a strong competitor for the outside world's cement trade.



THE KOEHRING CONCRETE MIXER.

A Labor Saving Concrete Carrier.

A new feature of the Koehring concrete mixer (described in detail in MUNICIPAL ENGINEERING, vol. xxxxiii, p. 283) is attracting considerable attention among paving contractors. This innovation is of a nature that its value will be at once apparent. It consists of a delivering carrier to take the concrete from the machine and deposit it at will upon the street surface, saving by its operation the labor of seven men.

The carrier consists of a 20-foot boom attached to the machine in such a way that it may be raised or lowered and may be swung in an arc of 90 degrees about its fixed end. Upon this boom is swung a steel carrier with a double door bottom dump. This carrier is arranged on rollers so that it may be moved out along the beam by means of a cable operating over a reversible drum.

The method of operation is simple in extreme and requires only two men on the entire mixer force. One man takes care of the charging and another operates the discharge and delivery of the mixture. The carrier bucket is filled and moved out along the boom to the required position where a laborer whose work it is to spread the concrete, dumps the charge. The return of the carrier helps, in a degree, to spread the concrete, thus aiding the men alloted to this work.

The accompanying photograph shows one of the machines in operation. This particular machine has a record of 80,-000 yards laid, some of which was put in place at a cost as low as 4 3-10 cents per yard. Full catalogues and prices of the machines may be had of the Koehring Machine Co., Germania Bldg., Milwaukee, Wis.

Bitulithic Pavement in Oklahoma.

BY W. B. NEAL.

In the fall of 1901 a few of the citizens of Miami, Okla., believing that one of the best assets for a growing city is improved streets, started an agitation advocating the paving of Main street and Fourth street with a modern high-grade pavement. The efforts of a few who first advocated the improvement met with a hearty approval of the citizens, so that it was practically the unanimous sentiment of the community that we should improve our streets.

A joint committee of the city council and taxpayers was appointed. After careful investigation of all classes of pavements being laid in Oklahoma and adjoining states, including bitulithic pavements laid in Texas, the committee finally recommended the use of bitulithic pavement for the improvement to be made, regardless of the fact that representatives of rival pavements offered their products at lower prices.

In due course, after passing through the arduous route which paving proceedings have to take under the Oklahoma law, a contract was made aggregating approximately 28,000 sq. yds. in our city in the early summer of the present year, and the contractor, P. S. Kaull, completed the bitulithic pavement in the latter part of July. I believe that I can truthfully say that it is practically the unanimous opinion of our citizens that we have absolutely the best pavement that there is in the state of Oklahoma today. Of course, as is always the case, there were a few, and I am pleased to say a very few in this case, property owners who objected to the improvement being made, but I feel certain that even those few are now of the opinion that the city has gotten a first-class pavement and that it has not only made no mistake in providing for street improvements, but also in selecting the bitulithic pavement.

Miami was the pioneer city in Oklahoma to adopt bitulithic pavement for the improvement of its streets, but since that time I understand that Bartlesville has adopted this pavement and that the work at Bartlesville is now under construction. Doubtless next year will see a large increase of bitulithic pavement laid in the state of Oklahoma.

History of the New York-Port Huron Roller.

The New York-Port Huron roller was designed in the year 1905-6 by Charles Longenecker, M. E., and E. T. Wright, M. E. The experience of Mr. Longenecker included the designing of the Harrisburg roller, and several years with that company at Harrisburg, Pa. He was vice-president of the Weston Engine Company, Painted Post, New York, for several years after leaving the Harrisburg Foundry and Machine Company.

Mr. Longenecker became a member of the firm of Julian Scholl & Co., of New York, some time prior to the year 1890, and that firm took the agency of the Kelley-Springfield rollers in New York and other eastern states. After the sales agreement or territory arrangements between the Kelley and Pitts and the Harrisburg companies, and loss by Julian Scholl & Co. of the agency of the Kelley, Mr. Longenecker, in collaboration with Russell & Co., Massillon, O., designed and placed on the market the Russell roller; this was in about the year 1895. They continued marketing the Russell roller until the year 1901, when Russell & Co. sold their roller business to the Kelley-Pitts combination. In the years 1902-3 Mr. Longenecker had the sale of the Pitts roller in southern New York and in the New England states. In 1904 Mr. Longenecker began the development of the larger sizes of universal roller made by Julian Scholl & Co. In May, 1905, he left Scholl & Co. and in December, 1905, he organized the Chas. Longenecker & Co. firm, and commenced the development of the New York roller and the New York scarifier.

Mr. Wright's experience in the roller business commenced in England. He served his apprenticeship with the Aveling & Porter Co., of Rochester, England, the first manufacturers in the world of what is nowadays known as the Standard road roller, and now the largest makers in the world of steam road rollers. From Rochester, England, Mr. Wright came to Harrisburg, Pa., and in the draughting room of the Harrisburg Foundry & Machine Company at the time the Harrisburg roller was designed. Later he was for nine years with the Kelley-Springfield Company, then called the O. S. Kelley Company. In 1903 he went with the newly formed American Road Roller Company, and then designed the American, now known as the Monarch roller. In November, 1905, he became associated with Mr. Charles Longenecker and was associated with him in the design of the present New York roller, which has lately been purchased by the Port Huron Engine & Thresher Company, Port Huron, Mich.

Trade Publications.

"The Bar That Never Failed," is devoted to the description of the M-B reinforcing bar, and its use in various buildings. Special locking and spacing devices and formulae and tables for computing reinforcement supplement the regular catalogue features of the book.

The A. S. Aloe Company, of St. Louis, have issued a bargain circular giving special prices on various engineering supplies, instruments, etc.

"Sluice Gates and Other Water Works Appliances" is the subject of a 35-page illustrated catalogue of the Coldwell-Wilcox Company, of Newburgh, N. Y. Complete details and tables of the appliances are given, as well as the half-tones common to such catalogues.

The New York Bridge and Iron Company have a small catalogue describing Paradigm skylights, Simplex-Duplex interlocking steel stairs, and various other steel building sundries.

Keuffel & Esser Company, Hoboken, N. J., issue a circular descriptive of the Payzant (freehand) lettering pen, a device for making block or other heavy letters with a single stroke. The same company also has an improved theodolite with an 8-inch horizontal limb.

The Modern Iron Works, of Quincy, Ill., issues a booklet descriptive of a sewage disposal system for suburban residences, hotels, colleges, prisons, etc., not accessible to public sewers. The method is by intermittent surface or subsurface irrigation.

The International Harvester Company, of Chicago, has instituted a service bureau to cover the field and problems of farm-

The International Asphalt Company, of Chicago, have a leaflet descriptive of Cubanel, a road binder made from Cuban asphalt.

Bulletin No. 42 issued by the Jeffrey Manufacturing Co., of Columbus, is devoted to the description and illustration of coal handling and mine equipment machinery. It is very complete in detail and is illustrated by photographs of installations now in use. Booklet 28 issued by the same company deals with conveying machinery for handling stone, sand, gravel, ores, etc. This booklet is also illustrated in a very complete manner. Bulletin No. 42 and Booklet 28 may be obtained by writing The Jeffrey Manufacturing Co., Columbus, O.

The National Brake and Electric Co. have issued an illustrated book on motor and belt-driven air compressors. Tables of dimensions, capacities and other data of value are included in the book.

The Vulcanite Portland Cement Co. issues a printed leaflet entitled "Things Worth Knowing About Concrete." The latest edition includes a method of bonding new concrete to old and also the sodium silicate method of preventing dusting or easy erosion of concrete floors.

"What is asphalt?" is the question answered by a booklet of that title issued by The Texas Company. The term asphalt is defined and the difference between asphalt and the bitumens is made clear in this discussion. The method used by The Texas Company in preparing their products is taken up and described.

Trade Notes.

BITULITHIC.

Trenton, N. J.—By a unanimous vote, the street committee of common council accepted the Princeton avenue bitulithic pavement. Chairman Wiggins said he was satisfied that the work had been well done; Mr. Mayers called attention to the fact that the city was protected by a five years' guarantee, and City Engineer Swan, who had inspected the work daily during its progress, said that the specifications had been followed in all particulars. Mr. Mayers made the motion to accept the pavement and Mr. Plant seconded it. Mr. Reichert, the minority member of the committee, who resides in the Fifth ward, through which the pavement runs, joined his colleagues in declaring that the pavement was satisfactory.

BRICK.

Rich Hill, Mo.—The work of rebuilding the vitrified brick and tile plant, recently destroyed by fire, has begun.

CEMENT.

Sanders, Me.—The Roman Artificial Stone and Tile Co. has been organized to deal in Portland cement, concrete, etc. Samuel Clark, pres., Kennebunk, Me.

CONCRETE BLOCKS.

Arlington, O.—The Arlington Cement Tile Co. has been incorporated by Wm. Rinehart, George Kimmell, G. W. Myers, and P. J. Dillman.

Wichita, Kan.—The Wichita Cement Brick and Supply Co. has been incorporated by John Tracy, Miller Dobbin, J. C. Pierson and others.

PURCHASE OF MACHINERY.

Birmingham, Ala.—Special.—J. A. Montgomery, 905 First National Bank building, desires to purchase a standard drill, oil or gas.

Chanute, Kan.—Special.—J. S. Rustamier, 10 North Grant street, advises us that he may be in the market for a 30 or 40-h.p. road engine, double cylinder.

Grants Pass, Ore.—This city will vote on the question of purchasing a steam roller, at a cost of about $2,400.

LIGHT, HEAT AND POWER.

Atlantic Highlands, N. J.—The Monmouth Shore Gas Co. has been incorporated to operate gas works, by H. E. Woodman, A. M. Worstall, both of Real Estate Trust building, Philadelphia, and Harry Stille, Clayton, N. J.

Dover, Del.—The Cities Service Co., New York City, has filed articles of incorporation here, to operate works, plants, etc., for the generation and purification of natural and artificial gas and to lay mains, pipes and conduits, for its distribution for lighting, heating and power, or any other use to which gas may be applied. The incorporators are Anselm P. Anderson, New York City, and James M. Satterfield and Artly B. Magee, of Dover.

MISCELLANEOUS.

Chicago, Ill.—The Illinois Cast Iron Pipe and Foundry Co. has been incorporated by A. M. Osburn, W. M. Umbdenstock and A. G. Bower.

Evansville, Ind.—The Anchor Roofing and Paving Co. has changed its name to the Anchor Concrete Construction Co.

SEWER PIPE AND DRAIN TILE.

Williamsburg Va.—W. L. Jones has erected the first drain tile plant in eastern Virginia.

Patents Concerning Construction and Operation of Water Plants.

864,151. Manual Scraping Machine (for removing material from filters). Hiram W. Blaisdell, Los Angeles, Cal.

875,002. Valve for Stand Pipes. Wm. H. Sellow, Detroit, Mich.

878,960. Shell Dam (concrete). Edwin B. Jennings, New York, N. Y.

886,798. Fire-Hose Bridge. Robert C. Groh, St. Paul, Minn.

890,598. Wall Strainer. Arthur M. Brown, Houston, Tex.

894,220. Device for Cleaning Water Mains. John Maslin, Jersey City, N. J.

894,873. System of Cleaning Filters. Hiram W. Blaisdell, Los Angeles, Cal.

897,755. Combined Fresh and Salt Water Hydrant. Frank Malloye, San Francisco, Cal.

899,703. Dam. Wm. M. Ransom, Warren, R. I.

902,733. Dam (concrete). John F. Jackson, Houghton, Mich.

905,906. Water Meter. Sylvester L. McAdams, Beaver Falls, Pa.

905,915. Hydrant. Denis F. O'Brien, Newark, N. J.

907,328. Molded Strainer or Screen for Wells, Filters and the Like. John R. Freeman, Providence, R. I. (Concrete.)

908,058. Removing Sludge from Sedimentation Basins and Reservoirs. David C. Williamson, New York, N. Y.

910,495. Means for the Purification of Water. Douglas L. V. Browne, San Francisco, Cal.

910,687. Flexible Pipe Joint. Charles H. Jenkins, Louisville, Ky.

911,609. Deep Well Pump. Robert C. Purcell, Oakland, Cal.

912,885. Reinforced Concrete Water Pipe or Conduit. John M. Phelan, Jackson, Mich.

913,123. Double Acting Deep Well Pump. Jas. Gleason, Green Bay, Wis.

914,399. Water Power System. Salathiel C. Fancher, Kansas City, Mo.

914,559. Dam (concrete). Wm. G. Fargo, Jackson, Mich.

12,932 (Reissue). Distributing Machine for Closed Filters. Hiram W. Blaisdell, Los Angeles, Cal.

917,918. Water Purification System. John F. Wixford, St. Louis, Mo.

918,678. Reinforced Cement Sectional Conduit. Hugh J. Keenan and Edmund J. Tobin, Jackson, Mich.

923,831. Dam. Newton L. Hall, San Diego, Cal.

923,985. Dam and Method of Building the Same. Daniel E. Moran, Mendham, N. J.; John W. Doty, Edwin S. Janett, New York, N. Y.

924,682. Method of Washing Filter Sand. P. J. A. Maignen, Philadelphia, Pa.

928,663. Hydrant. Geo. W. Johnston, Springfield, Mass.

928,863. Cleaner for Mains and Pipes. Hugh A. Greenan and Frank O. Redford, Louisville, Ky.

929,110. Device for Cleaning Pipe Lines. Edward R. Reese, Tamaqua, Pa.

931,032. Filtering Bed. Paul F. Bussman, Buffalo, N. Y.

935,637. Method of Purifying Water. Wm. B. Ball, Chicago, Ill.

937,210. Process of Preparing Potable Water. John T. Harris, New York, N. Y.

942,436. Cement Lined Pipe and Fittings. Frank H. Caney, Newton, Mass.

944,527, 944,528. Method of and Apparatus for Cleansing Filter Beds. Zdenko von Wessely, Prague, Austria-Hungary.

945,596, 945,597. Street Valve and Fire Plug Boxes. Edward Prendergast, St. Louis, Mo.

945,971. Device for Cleaning Pipe Lines. John Maslin, Jersey City, N. J.

950,270. Meter Box. Lewis P. Andrews, Sedalia, Mo.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Regina, Sask.—Voted to issue $132,000 pavement bonds.

Iowa City, Ia.—Paving is contemplated for Washington st.

Little Rock, Ark.—Rock and Scott sts. are to be paved with asphalt concrete.

Lockhart, Tex.—Will vote in October on issue of $50,000 road bonds.

Duluth, Minn.—Tar macadam paving is contemplated for Eleventh ave., E., next year.

Kalispell, Mont.—Council contemplantes paving Main and other streets next spring.

Vancouver, B. C.—The city engineer estimates the cost of paving Broadway at $167,099.

North Yakima, Wash.—An appropriation of $40,000 for street work next year is contemplated.

San Angelo, Tex.—Will vote on the issue of $20,000 bonds for paving Chadbourne st.

Kennewick, Wash.—A resolution has been passed providing for grading and macadamizing A st.

Temple, Tex.—Paving is contemploted for about 1 mi. of residence streets. Cy. Engr. Smith.

Brazil, Ind.—Bids will be asked soon for improving Hendrix st. with crushed stone. Cy. coun.

Virginia, Minn.—A petition has been submitted to council asking for the paving of Walnut st.

Algona, Ia.—Council has authorized the construction of brick, cement block, or cement sidewalks.

Cincinnati, O.—Will vote in November on issue of $800,000 bonds for grade crossing elimination.

St. Petersburg, Fla.—Voted to issue $67,500 bonds for improving streets. M. W. Spencer, cy. engr.

Aitken, Minn.—The construction of cement sidewalks in Fourth and other streets is contemplated next spring.

Texarkana, Ark.—A paving district has been organized providing for creosoted blocks, asphalt or bitulithic paving.

Chisholm, Minn.—The construction of a road to the powder plant, 4½ mis. distant, is contemplated by the Commercial Club.

Hammond, Ind.—Remonstrances will be heard Oct. 3 on the proposed widening and extension of Calumet ave. Adam R. Ebert, chm. B. P. W.

Peoria, Ill.—Judge Slemmons, of the county court, overruled the legal objections raised by certain property owners

in the ordinance for paving Adams st., Sept. 23, and that thoroughfare will now be paved with creosoted wood blocks.

Springfield, Ill.—This city contemplates paving Spring, Pasfield, Edwards and a number of other streets. Frank H. Hamilton, cy. eng.

Cottonwood Falls, Kas.—The city council has adopted an ordinance providing that all old stone sidewalks are to be replaced with cement.

National City, Cal.—The bd. of trustees has ordered an election to vote upon a bond issue of $80,000 for street work and park development.

Brookfield, Mo.—A resolution has been approved providing for vitrified brick paving, curb and gutter in Monroe st. R. S. Brownlee, mayor.

Chester, Pa.—The construction of 3½ mis. of boulevard, extending from one end of the city line to the other, is contemplated. Frank W. Harrison, cy. clk.

Watertown, S. D.—Mayor Martin has appointed Aldermen Fahnestock, Lester and Hawley a committee to investigate the question of paving the business streets.

Buffalo, N. Y.—A resolution has been introduced directing Francis G. Ward, dir. pub. wks., to ask for bids for repaving Mohawk st. with asphalt and stone.

Walnut Grove, Ariz.—The residents have petitioned the board of supervisors for the construction of a wagon road from Prescott to this town. Address city clerk.

Youngstown, O.—A resolution has been passed to pave Williamson ave. Ordinances have also been passed to proceed with the paving of Woodhill ave. and Bryson st. A. W. Carver, mayor.

CONTRACTS TO BE LET.

St. Bernard, O.—Bids are asked until Oct. 3 for grading. Geo. Schroeder, vil. clk.

Peru, Ind.—Bids are asked until Oct. 6 for constructing 2 roads. Chas. Griswold, co. audt.

Franklin, Ind.—Bids are asked until Oct. 15 for constructing a highway. Wm. B. Jennings, co. audt.

Vincennes, Ind.—Bids are asked until Oct. 2 for constructing 3 gravel roads. J. F. Scott, co. audt.

Kokomo, Ind.—Bids are asked until Oct. 5 for constructing a gravel road. A. B. Easterling, co. audt.

Sullivan, Ind.—Bids are asked until Oct. 4 for constructing 3 rock roads. Ben C. Crowder, co. audt.

Rensselaer, Ind.—Bids are asked until Oct. 4 for constructing 5 stone roads. Jas. N. Leatherman, co. audt.

Winamac, Ind.—Bids are asked until Oct. 4 for constructing gravel roads. Ellis S. Rees, co. audt.

Grand Rapids, Minn.—Bids are asked until Oct. 5 for constructing a highway. M. A. Spang, co. audt.

Scottsburg, Ind.—Bids are asked until Oct. 4 for constructing 4 gravel roads. Frank Gardner, co. audt.

Spencer, Ind.—Bids are asked until Oct. 4 for constructing a macadamized road. Geo. W. Edwards, co. audt.

Peru, Ind.—Bids are asked until Oct. 6 for constructing 2 roads. Chas. Griswold, co. audt.

Scottsburg, Ind.—Bids are asked until Oct. 3 for constructing 4 gravel roads. Frank Cardner, co audt.

Knox, Ind.—Bids are asked until Oct. 3 for improving 2 roads. Lee M. Ransbottom, co. audt.

Ames, Ia.—Bids are asked until Oct. 12 for paving an alley with vitrified brick blocks. A. B. Maxwell, cy. clk.

Noblesville, Ind.—Bids are asked until Oct. 6 for constructing a gravel road on line between Marion and Hamilton cos. Geo. Grifling, audt. Hamilton co.; Albert Sahm, audt. Marion co.

Brazil, Ind.—Bids are asked until Oct. 7 for constructing a road in Harrison twp. Jas. L. Burns, co. audt.

Jefferson, Mo.—Bids are asked until Oct. 3 for curbing, guttering and macadamizing Clark ave. E. F. C. Harding, cy. engr.

Kokomo, Ind.—Bids are asked until Oct. 5 for constructing 3 mis. of gravel road. A. B. Easterling, co. audt.

Ft. Dade, Fla.—Bids are asked until Oct. 5 for constructing brick or concrete roads and concrete walks. Constr. Q. M.

Harrisburg, Pa.—Bids are asked until Oct. 6 for constructing 3 mis. of gravel road. Jos. W. Hunter, state highway comr.

Peoria, Ill.—Bids are asked until Oct. 15 for resurfacing Perry ave. with asphalt. Geo. E. Simmons, prest. bd. local impvts.

St. Augustine, Fla.—Bids are asked until Oct. 4 for constructing a public highway. B. Genovar, chm. co. comrs.

Wilmington, N. C.—Bids are asked until Oct. 15 for grading, paving and curbing certain streets. Louis S. Beldon, chm. st. comn.

Greencastle, Ind.—Bids are asked until Oct. 3 for constructing a macadam road. D. V. Moffett, co. audt.

Boonville, Mo.—Bids are asked until Oct. 3 for constructing a concrete sidewalk in Spruce st. Chas. G. Miller, cy. clk.

Toledo, O.—Bids are asked until Oct. 3 for paving 19th st. with vitrified paving blocks on concrete. Fred Shane, secy. B. P. S.

Hammond, Ind.—Bids are asked until Oct. 5 for constructing cement sidewalks in Ames and Walnut aves. Adam R. Herbert, chm. B. P. W.

Santa Barbara, Cal.—Bids are asked until Oct. 3 for grading sections Nos. 4 and 5 of Coast road, in road dist. No. 3. A. A. Hunt, co. clk.

Princeton, Ind.—Bids are asked until Oct. 5 for constructing 4 gravel roads. Joseph P. Yochum, chm. co. comrs.; Wm. T. Roberts, co. audt.

Birmingham, Ala.—Bids are asked until Oct. 5 for certain brick paving, street grading, retaining walls, etc. Maury Nicholson, cy. engr.

Ft. Still, Okla.—Bids are asked until Oct. 15 for grading roads and constructing concrete walks in new Artillery Post. Capt. David L. Stone, Constr. Q. M.

Lafayette, Ind.—Bids are asked until Oct. 5 for constructing 2 mis. of gravel on Island road, and 2¾ mis. macadam in Riverside road. A. G. Arnold, co. engr.

Lockland, O.—Bids are asked until Oct. 3 for paving Wayne ave. with vitrified brick, with concrete curbs, gutters, and crosswalks. C. E. Troy, vil. clk.

Ridgefield Park, N. J.—Bids are asked until Oct. 3 for paving with Amiesite macadam, grading, curbing, manholes, etc. E. S. Carr, prest. bd. vil. trustees.

Spokane, Wash.—Bids are asked until Oct. 5 for cleaning, grubbing, grading and draining state roads Nos. 10 and 16. Henry Bowlby, secy. state highway bd., Olympia.

Shelbyville, Ind.—Bids are asked until Oct. 6 for constructing cement sidewalks in Franklin st. and cement curbs and gutters in Walnut st. L. E. Webb, cy. clk.

Cincinnati, O.—Bids are asked until Oct. 4 for macadamizing 2.9 mis. of road in Whitewater twp. Stanley Struble, prest. co. comrs.; Jas. C. Wonders, state highway comr.

Fostoria, O.—Bids are asked until Oct.

17 (corrected date), for paving 6 streets with brick or bitulithic, with concrete and stone curbing. Chas. Latshaw, cy. engr.

Red Lake Falls, Minn.—Bids are asked until Oct. 7 for constructing 8,000 sq. ft. cement sidewalk, 400 ft. curb, and a reinforced concrete retaining wall at the court house. A. A. Latendress, co. audt.

Crookston, Minn.—Bids are asked until Oct 11 for paving Houston ave. and S. Ash, E. Fletcher, E. Robert, E. 2nd and E. 3rd sts. with asphalt, creosoted blocks, donnelite, and granitoid. A. M. Childs, cy. clk.

La Mowe, N. D.—Bids are asked until Oct. 4 for grading the grounds around the court house, involving the moving of 10,500 sq. yds. of earth, and constructing a driveway and curb. C. J. Alister, co. audt.

Toledo, O.—Bids are asked until Oct. 10 for treating the stone improvement, Brown road, with 3 applications of carbovia No. 2; until Oct. 14 for the repair of stone road No. 29; until Oct. 19 for grading, draining and macadamizing Glendale ave. Chas. J. Sauzenbacher, co. audt.

CONTRACTS AWARDED.

Carrollton, Mo.—J. C. Sykes was awarded a contract for brick paving for $83,440.

Scranton, Pa.—The contract for constructing 2 mls. of macadam road was awarded to W. W. Cobley.

Ocean Park, Cal.—L. Pearson & Co. was awarded a contract for improving Indiana ave. for $7,060.

Grants Pass, Ore.—Warren Construction Co. has been awarded contract for 3,500 sq. yds. bitulithic pavement.

York, Pa.—Standard Bitulithic Paving Co. was awarded the contract for paving Duke st. at $2.23 a sq. yd.

Pasadena, Cal.—The contract for improving El Molino ave. was awarded to Jas. M. Montgomery, for $10,492.

Memphis, Tenn.—The contract for paving East st. was awarded to the Memphis Asphalt Co., for $22,143.

Newark, N. J.—Wm. Ballard was warded the contract for grading and curbing S. 12th st., for $4,440.

Parsons, Kas.—Hardman & Gaffery secured the contract for curbing and guttering and macadamizing Clark ave.

Muncie, Ind.—The contract for constructing a public highway was awarded to Daniels & Lyst, of Anderson, Ind.

Memphis, Tenn.—The contract for paving Anderson st. was awarded to H. P. Streicher & Co., of Toledo, for $3,850.

Ambridge, Pa.—The contract for paving was awarded to the George B. Patterson Co., of East Liverpool, O., for $5,000.

Schenectady, N. Y.—The contract for paving Wall st. was awarded to the Schenectady Constructing Co., 332 State st.

Corvallis, Ore.—Contract for 44,000 sq. yds. bitulithic has recently been awarded to Warren Construction Co.

Florence, Ala.—The contract for paving Walnut st. with crushed limestone was awarded to J. H. Angel, for $8,000.

Vincentown, N. J.—The contract for constructing a stone road was awarded to E. C. Humphrey, of Hackensack, for $22,452.

Klamath Falls, Ore.—The Warren Construction Co. has been awarded contract for paving with bitulithic, 50,000 sq. yds.

Leadville, Colo.—The Municipal Construction Co. was awarded a contract for paving Montclair Parkway, for $98,750.

Erie, Pa.—Lininger & Bennett, of Conneaut, O., secured the contract for 10,000 ft. of concrete curb and gutter.

Cincinnati, O.—The John Ruebel Construction Co., Hayes ave., Cincinnati, was awarded a contract for improving the Harrison and New Haven road, for $29,267.

Riverside, Cal.—Oscar Ford was awarded a contract for constructing 4 mis. of the Big Springs Canyon road, for $17,950.

Twin Falls, Idaho.—F. W. Whittier was awarded a contract for 84,000 sq. ft. of concrete paving, at 13 cts. a sq. ft.

Albert Lea, Minn.—The contract for curbing College st. was awarded to the Albert Lea Construction Co., for $3,929.17.

Reading, Pa.—John E. Weidner was awarded a contract for paving Plum st. with vitrified blocks, at $1.91 a sq. yd., or $900.80.

Duluth, Minn.—John A. Johnson was awarded a contract for paving Irving Place, 7th and Clover st. with granitoid blocks, for $27,033.

Chattanooga, Tenn.—The West Construction Co. was awarded the contract for grading McCallie ave. preparatory to paving, for $9,407.

Portland, Ore.—Contracts for paving with bitulithic aggregating 80,000 sq. yds. have been awarded to the Warren Construction Co.

Columbus, O.—The contract for paving N. High st. with asphalt was awarded to the Andrews Asphalt Paving Co., Sept. 15, for $70,000.

Sullivan, Ind.—The contract for constructing a stone road in Cass twp. was awarded to Ward Hawkins, of this city, for $8,240.

Marion, Ind.—The contract for paving 9th st. with macadam was awarded to Davidson & Bangher, of Windfall, Ind., for $26,847.

Chelan, Wash.—The Eagle Transfer Co., of Wenatchee, was awarded the contract for constructing 5 mis. of state road No. 10.

Taylor, Tex.—The contract for constructing macadam roads was awarded to the Texas Building Co., of Ft. Worth, for about $200,000.

Rome, N. Y.—Contracts have recently been awarded to the Warren Bros. Co. for paving E. Willett and Elm sts. with bitulithic.

Youngstown, O.—The improvement of the Petersburg and Youngstown road was awarded to G. A. Garfield & Co., of Girard, O., for $14,820.

Herkimer, N. Y.—Warren Bros. Co. has recently been awarded additional contract in Herkimer for paving Prospect st. with bitulithic.

Klamath Falls, Ore.—The contract for bitulithic paving was awarded to the Warren Bros. Construction Co., 59 Temple st., Boston, at $2.20 a sq. yd.

Brantford, Ont.—Contract for paving Darling st., from George to Market, with bitulithic has been awarded to the Warren Bituminous Paving Co.

Newark, N. J.—The contract for paving 4 mis. of Pleasant Valley Way with telford was awarded to Robert Doriety, 29 Highland ave., for $29,624.95.

Kansas City, Kan.—Contract for paving Quindaro Boulevard, from 17th to 19th st., was awarded to the Kansas Bitulithic Co., 5,850 sq. yds.

Columbus, O.—Contracts have been awarded as follows: Tar binder on Chillicothe road, Foley Bros., $8,000; macadamizing Clinkinger road, Yardley & Wilson, $4,000.

Toronto, Ont.—The Warren Bituminous Paving Co. has been awarded contract for paving Marshall st., from Block ave. to Sheridan st., with bitulithic.

Indianapolis, Ind.—Contracts have been awarded as follows: Paving Washington Boulevard, from 36th to 40th sts., with asphalt, brick gutters and curbing, Union Asphalt Co., $6.51; resurfacing E. Wash-

ington st., Marion County Construction Co., $4.10 a lin. ft.

Dayton, O.—David Beard has been awarded paving contracts as follows: Wyoming st., two sections, $11,716 and $3,697; Burns ave., $9,035; Logan ave., $2,476; 6th st., $3,060.

Chicago Heights, Ill.—Paving contracts have been awarded as follows: Lowe ave., G. H. Myrick, of Chicago, $5,800; Wallace st., Chicago Heights Coal Co., $5,975.

Milwaukee, Wis.—The contract for the permanent improvement of North st. and West ave. was awarded to G. H. Stanchfield, of Fond du Lac, at $1.91 per ft., or $15,561.57.

Scarsdale, N. Y.—W. H. McCabe, of White Plains, N. Y., was awarded the contract for resurfacing with bituminous macadam the New York Port road, in this town, for $20,000.

Richmond, Cal.—Contracts for macadam paving have been awarded as follows: 12,332 sq. yds. in 5th st., Geo. Galbraith, $13,919; 20,533 sq. yds. in Ohio st., J. J. Davies, $17,886.

Corvallis, Ore.—The Warren Construction Co., 59 Temple st., Boston, was ton, Jefferson, Monroe and 3rd sts. with bitulithic, for $200,000.

Ft. Du Pont (Delaware City, P. O.), Del.—H. C. Clark, of Delaware City, was awarded the contract for macadamizing 1,929 sq. yds. of Post Penn. road, adjacent to this post, at $1.29 a sq. yd.

Boston, Mass.—L. C. Carchis was awarded the contract for constructing a state highway in Ewing, for $8,711. The contract for a state highway in Franklin was awarded to C. E. Horne, for $5,273.

Atlantic, Ia.—The contract for constructing 41 blocks of asphalt macadam paving was awarded to the Capital City Co., for $97,000, and the contract for curb and gutter to Wm. Horrabin, for $14,000.

Elizabethtown, Pa.—The contract for building a macadamized road, a water plant, a concrete bridge, and 2 mis. of cobble gutters was awarded to John Goll & Co., 1539 Filbert st., Philadelphia, for $51,676.

Cambridge, Mass.—The city of Cambridge has recently awarded contract to the Warren Bros. Co. for paving such streets as may be designated by the Superintendent of Streets during the season of 1910 with bitulithic.

Rochester, N. Y.—Contracts for brick paving have been awarded as follows: Genessee st., Whitmore, Rauber & Vicinus, 274 South ave., $21,541; Arnett st., Hagaman, Miller & Hagaman, 16 State st., $52,012.

New Albany, Ind.—The contract for constructing sidewalk improvements for the remainder of the year was awarded to Wm. O. Sweeney, of Jeffersonville, at 14¾ cts. a sq. ft. for sidewalks and 3¾ cts. a sq. ft. for grading and sodding grass plots.

St. Louis, Mo.—The following contracts for paving with bitulithic have been awarded to the Granite Bituminous Paving Co.: Arsenal st., 8,630 sq. yds.; Semple st., 5,998 sq. yds.; Union st., 10,003 sq. yds.; Bent ave., 4,780 sq. yds.; Porlis, 3,477 sq. yds.

Massillon, O.—Paving contracts have been awarded as follows: E. Cherry and N. Erie sts., Philip Diefenbacher & Lewis; Pearl and Dwight sts., Geo. P. Williams; Wissman, S. Waechter, Green and Walnut sts. and Woodland and Commonwealth aves., Urban & Schott.

Ft. Dodge, Ia.—The Bryant-McLaughlin Asphalt Paving Co. was awarded the contract for paving 1st ave., 16th and 13th sts. with asphalt, as follows: Paving, $1.98 a sq. yd.; extra grading, 39 cts. a cu. yd.; overhaul of — ct.; restoring old curbs, 20 cts a lin. ft.; building combined Portland cement curb and gutter, 65 cts. a lin. ft.; street railway paving, $3.19 per sq. yd.

Springfield, O.—Edward Ryan was awarded the contract for E. High st. and College ave., of this city, for $24,878 and $11,167. The material to be used will be Trinidad Lake asphalt, with Nelsonville block between the car tracks set in asphalt filler.

Los Angeles, Cal.—C. Strausburg, H. W. Heilman Bldg., was awarded a contract for constructing 1 mi. of new streets in one of the Briggs Co.'s tracts at 2nd and Harvard sts., for $15,000. The streets will be graded and graveled, and cement sidewalks, curbs and gutters constructed.

Wichita, Kas.—The Cleveland-Trinidad Paving Co. will be awarded the contract for paving Riverside ave. with asphalt, as follows: Curb, 23c; gutter, 33c; excavating, 45c; asphalt, $1.99. The Warner-Quinlan Co. bid: Curb, 25c; gutter, 35c; excavating, 45c; asphalt, $2.

Lafayette, Ind.—Contracts for constructing gravel roads have been awarded as follows: Frisby road in Washington twp., to James F. Pierce, at $3,500; the Middleton road in Wabash twp. and the Mathier road in Shelby twp., to Snyder & Jenkins, of Frankfort, Ind., at $4,375 and $3,596, respectively.

Crown Point, Ind.—Contracts for constructing 6 gravel roads have been awarded as follows: Three to Nejdl & Greenwald, Whiting, Ind., $4,049, $7,550 and $15,900; one to Wm. Ahlbourn Construction Co., Hammond, Ind., $3,760; two to Downey & Portz, St. John, Ind., $16,400 and $19,100.

Billings, Mont.—The contract for constructing cement sidewalks, curbs and alley crossings in dists. Nos. 59, 61 and 62 was awarded to S. R. Birch & Sons, of Salt Lake City, as follows: Cement sidewalk, 15.4 cts. a sq. ft.; curbs, 43 cts. a lin. ft.; alley crossings, 30 cts. a lin. ft. Thos. Moore was awarded a contract for alley crossings and driveways in dist. No. 60, at 20.5 cts a sq. ft.

Oklahoma City, Okla.—(Special). Bids were submitted, Sept. 19, for street paving and contracts will probably be awarded as follows: Cleveland-Trinidad Paving Co., asphalt—1st. st., $45,582.30; Pottawatomie ave., $34,382.70; Western Paving Co., asphalt—Avenue B, $44,846.65; 9th st., $44,714.72; Avenue A, $142,863.36; 26th st., $88,822.72; Military ave., $52,-815.48; Main st., $33,610.18; 24th, 25th, 26th and Broadway sts., $21,947.88; Putnam Heights boulevard, $4,268.69. F. P. McCormick, asphalt—Linwood blvd., $76,-258.81; Agnew st., $16,166.53. Shelby-Downard Co., Ardmore, Okla., Ardmore rock asphalt—11th st., $2,179.91; Central ave., $9,131.88; 7th st., $9,584.97; Dewey st., $19,150.42; Noble ave., $6,174.81; 7th st., $6,424.32; Lee ave., $7,613.71; Central ave., $4,739.71; Walnut ave., $16,-657.31; 12th st., $2,544.12.

Columbus, O.—Bids were submitted, Sept. 3, for improving N. High st., as follows: Wood block—U. S. Wood Preserving Co., $114,924; A. G. Pugh, Columbus, $117,925. Asphalt block—William H. Graham, Columbus, $102,526; A. G. Pugh, $111,958. Stone block—A. G. Pugh, Salisburg stone with cement filler, $137,-554; Salisburg stone with tar filler, $138,-202; Salisburg stone with asphalt filler, $147,598; William M. Graham, granite and Medina stone with tar and cement filler, $149,296; with asphalt filler, $154,-156; Salisburg stone with tar and cement filler, $154,156; with asphalt filler, $159,-016. Paving with brick—A. G. Pugh,

Fultonham block, $77,614; Harris block, $78,586; Portsmouth block, $79,234; Nelsonville block, $80,206; D. & D., $86,038. Paving with sheet asphalt—Andrews Asphalt Paving Co., Bermudez, $70,929; Cleveland Trinidad Paving Co., Cleveland, California Trinidad, $77,138; A. G. Pugh, Cubanel, $81,179; William M. Graham, California, $84,260.

Huntington, W. Va.—Paving contracts were awarded, Sept. 6, as follows: Fourth ave., from Eleventh to 16th sts., 14,170 sq. yds., Metropolitan brick, 4,810 lin. ft. of combined curb and gutter, to Freshwater & Son, of Chester, W. Va., at $21,241. Seventh ave., from Tenth to 16th sts., 14,210 sq. yds., Metropolitan brick and 5,825 lin. ft. of combined concrete curb and gutter, to Freshwater & Son, at $21,681. Eighth ave., from Twelfth st. to a point 230 ft. east of Smith st., 15,220 sq. yds. of Portsmouth granite, 7,300 lin. ft. of combined concrete curb and gutter, to Harrison & Dean, of Huntington, at $21,038. 20th st., from Eighth ave. to Ritter ave., 8,800 sq. yds. of Portsmouth granite, 4,000 lin. ft. of 6x8-in. edging, to Harrison & Dean, at $11,056. Van Buren ave., between 13th and 14th sts., west, and 13th st., west, from Van Buren ave. to the C. & O. R. R., 1,650 sq. yds. of Portsmouth granite, 1,180 lin. ft. of edging, to Ullom & Scanlon, at $2.25. Tenth st., between Sixth ave. and the C. & O. R. R., 2,450 sq. yds. of Metropolitan brick, 860 ft. of concrete curb and gutter, to Freshwater & Son, at $2,642.

Hartford, Conn.—Contracts for state road work have been awarded as follows: Beacon Falls—2,325 lin. ft. gravel-telford road, including three 15-in. and one 18-in. tile culverts, to Merritt & Bush, Stamford, Conn., $1.25 per lin. ft. for gravel; $2 for telford; $1.25 for rubble drain, and $6 per cu. yd. for masonry walls. Enfield—3,705 lin. ft. macadam-telford road on the Hartford-Springfield turnpike, to Amos D. Bridge's Sons, Inc., Hazardville, Conn., $2.49 per lin. ft. for macadam; $3.49 for telford; $1 for rubble drain, and $3 per sq. yd. for brick work. Cromwell—On the Hartford-Saybrook turnpike, to the Pierson Engineering & Construction Co., Bristol, Conn., for resurfacing about 4,200 lin. ft of road with a bitulithic treatment. Haddam—On the Hartford-Saybrook turnpike, to Roger Kennedy, for resurfacing about five miles of graded and gravel road with trap-rock splinters. Simsbury—1,562 lin. ft. macadam-telford road, to Antonio Vito, of Thompson, Conn., at $3.26 per lin. ft. for macadam; $3.76 for telford; 98 cts. for rubble drain; 75 cts. per sq. yd. for cobble gutters; $5.50 per cu. yd. for masonry walls. East Granby—4,668 lin. ft. macadam-telford road, including two 30-in. and two 15-in. tile culverts and one reinforced-concrete arch culvert, to Antonio Vito, Thompson, Conn., $5.76 per lin. ft. for macadam; $5.96 for telford; 98 cts. for rubble drain; $5.50 per cu. yd. for masonry walls. Bloomfield—20,908 lin. ft. macadam-telford road, including six 12-in., four 15-in., two 24-in., and two 18-in. tile culverts, to A. D. Bridge's Sons, Inc., Hazardville, Conn., $1.61 for macadam; $2.31 for telford; $1 for rubble drain, and $6 per cu. yd. for masonry walls.

SEWERS.

CONTEMPLATED WORK.

Fordyce, Ark.—Plans have been prepared for constructing sewers.

Bryan, Tex.—Mayor Maloney is in favor of constructing a sewerage system.

Tecumseh, Neb.—The construction of sewers is contemplated. H. J. Enders, mayor.

Portland, Ore.—A resolution has been passed providing for a sewer in Adler st.

The Dalles, Ore.—A sewerage system will be installed next spring, at a cost of $400,000.

Eveleth, Minn.—Bids will be asked soon for constructing 1,500 ft. of 6-in. pipe sewer.

Newark, Del.—Plans are being prepared for constructing sewers. Wilbur Wilson, cy. engr.

Buffalo, N. Y.—Plans are being prepared for the readjustment of the present sewerage system.

Briggs, Cal.—Plans are being prepared for constructing a sewerage system and disposal plant.

Clinton, Ia.—Resolutions have been adopted for constructing sewers in Twelfth ave. and Fifth st.

Pottstown, Pa.—Plans are being prepared for constructing a sewerage system and disposal plant.

Olympia, Wash.—An ordinance has been passed for constructing a trunk sewer. E. L. Van Eppe, cy. engr.

Toppenish, Wash.—Will vote in October on issue of $35,000 bonds for constructing a sewerage system.

Sharon, Pa.—Plans are being prepared for constructing a sanitary sewerage system and disposal plant.

Ft. Worth, Tex.—City Engr. Trammell has recommended the constructing of a storm sewer in Jarvis st.

Bridgeton, N. J.—Plans are being prepared for the construction of a trunk sewer. Jacob B. Jones, cy. clk.

Wilmington, Del.—The city council has appropriated $30,000 for constructing a sewer in the Ninth ward, west of Market st.

Schenectady, N. Y.—Plans for constructing a surface water sewer are being prepared by J. Leland Fitzgerald, cy. engr.

Orange, Cal.—Plans will be prepared and contracts will be awarded about Jan. 1 for constructing a municipal sewerage system.

Ocean Park, Cal.—An ordinance has been passed to build a sewer in Fifth and Pennsylvania sts. G. A. Murray, cy. clk.

Belle Plaine, Ia.—Surveys for a sewer outlet for the sanitary sewer system will be made by Engineer Hart, of Clinton.

Williamsport, Pa.—Plans for constructing the East End sewer will be prepared by Carroll P. Bassett, sanitary engr.

San Francisco, Cal.—Ordinances have been passed for constructing sewers in sections C and F of the North Point main sewer.

Pittsburg, Pa.—An ordinance has been passed authorizing the construction of a sewer in Lopey alley. E. J. Martin, clk. coun.

Carlisle, Pa.—The construction of sewers in Mully Grub and Spring sts., including disposal plant, is contemplated.

Westfield, N. J.—Voted to issue $100,000 bonds for constructing an adequate sewerage system and erecting a disposal plant.

Ontario, Cal.—A resolution has been passed for constructing a vitrified pipe sewer in an alley. R. O. Brackenridge, cy. clk.

Tacoma, Wash.—A resolution has been passed providing for a sewer in N. Sixth and N. Seventh aves. and L st. F. L. Davis, cy engr.

Steubenville, O.—A resolution has been passed providing for the construction of a sewer in N Sixth st. Hugh W. Paterson, cy. clk.

Dallas, Tex.—The bd. of city comrs. adopted, Sept. 16, a recommendation authorizing the city engineer to prepare

plans and specifications for constructing storm sewers northeast of Masten st., and extending east to the Houston and Texas Central tracks.

Lafayette, Ind.—Plans and specifications have been adopted for the construction of a sewer, and remonstrances will be heard Oct. 5.

Zanesville, O.—An ordinance has been passed providing for the construction of a storm and sanitary sewer in Pine st. Neil Starkey, cy. clk.

Alliance, O.—Plans have been prepared for constructing a storm sewer from the old fair grounds to Washington st. A. Q. Kotte, cy engr.

Bastrop, Tex.—A special committee has been appointed, consisting of several aldermen and citizens, to investigate the cost of installing a sewerage system.

St. Charles, Ill.—Plans for constructing a new sewerage system, including a large septic tank, have been prepared by Henry Allen, cons. engr., of Chicago.

Lestershire, N. Y.—The town board of trustees will pass a resolution authorizing the drafting of plans and specifications and asking for bids for the Main st. sewer extension.

Creighton, Neb.—The executive committee of the Commercial Club voted to install a sewerage system. A committee composed of the president and secretary was appointed to investigate the matter.

Wichita, Kan.—Resolutions have been passed providing for the construction of surface drainage, catch basins and sewer on Gilbert st. and lateral sewers in district "A," of sanitary sewer district No. 12. Wm. Sence, cy. clk.

St. Louis, Mo.—Special.—The construction of sewers during the next year is contemplated, as follows: second section Baden public sewer, approximate cost of $181,000; third section River des Peres foul water sewer, $365,000; second section Glaise creek joint district sewer, $150,000; Rock Creek joint district sewer, $180,000. Sewers will also be built in numerous small districts, contracts for which can be undertaken by any contractor.

CONTRACTS TO BE LET.

Washington, Ind.—Bids are asked until Oct. 3 for constructing a ditch. A. F. Annen, co. surveyor.

Pasco, Wash.—Bids are asked until Oct. 4 for constructing a sewerage system. L. D. Conrad, cy. clk.

Tama, Ia.—Bids are asked until 8 p.m., Oct. 3, for constructing a sewage pump or lift. Lee I Carson, cy. clk.

Frankfort, S. D.—Bids are asked until 8 p.m., Oct. 3, for constructing sewers. Robt. J. Dickson, cy audt.

Ames, Ia.—Bids are asked until Oct. 12 for constructing 788 ft. 8-in. pipe sewer. A. B. Maxwell, cy. clk.

Mayfield, Pa.—Bids are asked until Oct. 3 for constructing an underground sewer. Theodore H. Wachna, chm. borough coun.

Sac City, Ia.—Bids are asked until Oct. 3 for constructing a certain sewer or sewer outlet. W. H. Townsend, mayor.

East Grand Forks, Minn.—Bids are asked until Oct. 4 for constructing 760 ft. 10-in. sewer in S. Fifth st. Jas. Gorman, cy. clk.

Columbus, O.—Bids are asked until Oct. 5 for constructing sewers in a large number of streets. H. S. Holton, dir. pub. service.

New York City.—Bids are asked until Oct. 5 for constructing sewers in various streets in Brooklyn. Alfred E. Steers, prest. borough.

Chicago, Ill.—Bids are asked until Oct. 5 for constructing sewers in a number of streets. Albert F. Keeney, prest. bd. local impvts.

Brawley, Cal.—Bids are asked until Oct. 3 for furnishing plans and specifications for a municipal system. W. H. Whelan, cy. clk.

New York City.—Bids are asked until Oct. 5 for constructing sewers in various streets in Brooklyn. Alfred E. Steers, prest. borough.

Pipestone, Minn.—Bids are asked until Oct. 3 for constructing 2,036 lin. ft. sewers in dists. Nos. 8115 and 8116. S. W. Fund, cy recdr.

Forman, N. D.—Bids are asked uutil Oct. 3 for constructing a septic tank in the rear of the county court house. R. P. Irving, co. audt.

St. Cloud, Minn.—Bids are asked until Oct. 31 for constructing an addition to a sewer outlet in Fourth st. S. Earl C. Scott, cy. clk.

Fargo, N. D.—Bids are asked until Oct. 5 for constructing a 12-in. lateral sewer in Fifth ave. S., Twelfth and Fourteenth sts. E. R. Orchard, cy. audt.

Plainfield, N. J.—Bids are asked until 8 p.m., Oct. 3, for constructing sanitary sewers and pumping stations. Jas. T. MacMurray, cy. clk.

Oakland, Cal.—Bids are asked until Oct. 6 for constructing a storm sewer, with appurtenances, in Market and Seventh sts. Walter N. Fawcett, secy. B. P. W.

Sonyea, N. Y.—Bids are asked until Oct. 11 for alterations to the sewage disposal plant at Craig Colony for Epileptics. Percy L. Lang, prest. bd. mgrs.

Morrisonville, Ill.—Bids are asked until Oct. 8 for constructing 50,000 ft. 10 to 27-in. vitrified tile, 6 retaining walls, etc. John M. Becker, town clk.

Angleton, Tex.—Bids will be asked until Oct. 4 for constructing canals, drains, ditches and laterals in said drainage district. O. W. Willits, chm. drainage comrs.

Norristown, Pa.—Bids are asked until Oct. 12 for constructing a sanitary sewer and laterals. Chas. C. Rambo, sewer com.; S. Cameron Corson, borough engr.

Goshen, Ind.—Bids are asked until 3 p.m., Oct. 3, for constructing a 10-in. sanitary sewer in S. Tenth st., from Purl st. to Plymouth ave. Geo. H. Rempler, cy. clk.

Indianapolis, Ind.—Bids are asked until Oct. 3 for constructing a local sewer in the alley west of West st., from McCarty to Wyoming sts. C. A. Schrader, prest. B. P. W.

Marshall, Ill.—Bids are asked until Oct. 3 for constructing vitrified pipe sewers, 3 brick manholes, 4 brick catch basins, and 8 curb inlets. Seymour Hurst, chm. bd. local impvts.

Emmetsburg, Ia.—Bids are asked until Oct. 3 for constructing sewers, repairing 4,792 ft. salt-glazed vitrified pipe sewers, 11 manholes, and 5 flush tanks. T. E. Rutledge, cy. clk.

St. Clairsvile, O.—Bids are asked until Oct. 10 for constructing a sewerage system and septic tank at the Belmont county infirmary, 3½ mis. west of this city. E. C. Shepherd, co. audt.

Fostoria, O.—Bids are asked until Oct. 17 (corrected date), for constructing sewers in 5 streets, requiring 2,350 ft. 12-in. and 1,460 ft. 15-in. pipe sewers. Chas. Latshaw, cy. engr.

Mansfield, O.—Bids are asked until Oct. 4 for constructing a storm sewer in Bowman st., requiring 840 ft. 18-in., 56 ft. 12-in., 100 ft. 4-in. and 40 ft. 8-in. sewer, 3 storm manholes, 5 inlets, and 1 lamphole. John Cahall, dir. pub. service.

Muskogee, Okla.—Bids are asked until Oct. 17 for constructing a storm sewer in dist. No. 12, requiring 2,000 cu. yds. brick or concrete masonry, 20,000 cu. yds. excavation, and 16,000 ft. 12 to 33-in. tile sewers. Chas. Wheeler, Jr., cy. clk.

CONTRACTS AWARDED.

Wakefield, Mass.—Jas. L. Byrne was awarded the contract for the West Chestnut st. sewer extension.

Dubuque, Ia.—The contract for constructing a sanitary sewer in Grandview ave. was awarded to W. F. Hassett.

Chandler, Okla.—The contract for constructing a sewerage system was awarded to J. S. Smith & Sons, of Oklahoma City.

Winchester, Ky.—The contract for constructing a sewerage system was awarded to E. T. Lewis & Co., for about $60,000.

Clarksburg, W. Va.—The contract for a sewerage system was awarded, Sept. 15, to John I. Dick, of Scottsdale, Pa., for $20,000.

Duluth, Minn.—Adam McAdam was awarded the contract for constructing a sewer in Fifty-ninth and Sixtieth alleys, fifth division, for $8,180.

Janesville, Wis.—The contract for constructing 5,933 ft. of sewer in various streets was awarded to Andrew Thompson, of Racine, Wis.

Canton, O.—The contract for constructing a storm sewer in Liberty and Saxton sts. was awarded to Turnbull & Dehn, for $25,528.

Muscatine, Ia.—The contract for constructing sub-sewerage dist. No. 20 of Main 1 was awarded to August Korneman, for $4,020.12.

Dunkirk, N. Y.—E. J. Kuehn was awarded a contract for constructing a sewer in W. Front st., Bingham road, an extension of the Deer st. sewer.

Pasadena, Cal.—The contract for constructing a reinforced concrete storm sewer was awarded to M. L. Hostetter, of Los Angeles, for $162,800.

Roanoke, Va.—C. Marley was awarded the contract for constructing sewers in Wise, Campbell, Kirk, Church and Tazewell aves., for about $5,000.

Albany, N. Y.—The contract for building a sewer in the Manning boulevard was awarded to M. F. Dollard, for $2,108.27, and in the Northern boulevard for $3,150.

Carrington, N. D.—Gilbert Haggart, of Fargo, was awarded the contract, Sept. 10, for constructing a main sewer system and 1¼ mi. of water main extension, for $60,000.

Rochester, N. Y.—The contract for constructing a sewage disposal plant at the Monroe County Tuberculosis Hospital was awarded to Bert Warren, of Honeyoye Falls, N. Y., for $5,000.

Swift Current, Sask.—Laidlaw & MacDonald, of Ft. William, Ont., were awarded a contract for constructing sewers and water mains, for $39,180, and sewage disposal works for $8,249.

Salt Lake City, Utah.—Special.—Dale L. Pitt was awarded contracts, Sept. 19, for constructing sewers as follows: extension No. 221, 99 cts. a lin. ft.; exten. No. 274, $1.11 a ft.

Corvallis, Ore.—J. A. Saucet was awarded a contract for constructing an additional sewer to cover Job's addition, College Hill, and the southeastern part of the city, for $110,700.

Forest Hills (Flushing P. O.), N. Y.—The contract for constructing a 42- and 48-in. reinforced concrete storm water drain for the Sage Foundation Homes Co. was awarded to D. Cuozzo, Park Row Bldg., New York City.

Tulare, Cal.—The Stanley Constructing Co., of San Francisco, was awarded the contract for constructing a sewer system, for $19,820. The contract for furnishing the pipe was awarded to N. Clark & Son, of this city.

Baltimore, Md.—William Shipley, 3404 Chestnut ave., city, was awarded a contract for constructing a private sewer, for $4,000. B. F. Sweeten secured contracts for sewer construction, for $67,371, and the Dietz Engineering Co., of New York City, for $17,360.

Grand Forks, N. D.—J. M. Carroll & Sons have been awarded contracts as follows: Water main extension No. 71, lateral sewer No. 12, district 4; lateral sewer No. 14, district 5.

Pasadena, Cal.—The contract for constructing a sewer in Hill, Chester, San Pasqual and Division sts. was awarded to Peter Gribavach, for $9,190. Chamberlain & Williamson secured the contract for building sewers in El Molino, Van Wyck, Prescott, Washington and Douglas sts. for $5,000. M. L. Hostetter will build 14,500 ft. of reinforced concrete sewer in Brooklyn, for $162,600.

Hawarden, Ia.—Roberts & Few, of Brookings, S. D., were awarded a contract for sewer construction, as follows: 2,550 ft. 12-in. sewer pipe, $1.20; 800 ft. 10-in., 90 cts.; 15,000 ft. 8-in., 70 cts.; 46 manholes, each $60; lumber per M. ft., $40; syphon, complete, $305; flood gate, $49; total, $16,914.

WATER WORKS.

CONTEMPLATED WORK.

Tower, Minn.—A water works system is contemplated.

Hearne, Tex.—A water works system is contemplated.

Nome, N. D.—Voted to install a water works system.

Roluleau, Sask.—A water works system is contemplated.

Kinsley, Kas.—The extension of the water mains is contemplated.

Maumee, O.—The construction of a water works system is contemplated.

Beecher, Ill.—Bids will soon be asked for constructing a water works system.

Jellico, Tenn.—Voted to issue bonds for constructing a water works system.

Eastland, Tex.—The construction of a water works system is contemplated.

Prentice, Wis.—The question of installing water mains is being agitated.

Highland Park, Mich.—Voted to issue $31,000 bonds for water works extension.

Shiner, Tex.—Voted to issue bonds for the extension of the water works system.

East Alton, Ill.—The bd. of local impvts. has accepted plans for water works.

Ephraim, Utah.—Voted to issue bonds for constructing a municipal water works system.

Yacolt, Wash.—Voted to issue bonds for system.

New Holland, Pa.—Will vote in November on the construction of a water works system.

Fond du Lac, Wis.—The village of North Fond du Lac contemplates the purchase of a water works system.

Aberdeen, Wash.—Additional pumping facilities in South Aberdeen are contemplated. Supt. water dept.

Mobile, Ala.—A map for extensions to the water works and sewer systems has been completed.

Lynn, Mass.—A site has been selected on Walnut st., at Lyndhurst, for a mechanical filter plant.

Pittsfield, Mass.—The bd. of ald. has appropriated $24,000 for a permanent pump at Onota Lake.

Rogers, Tex.—Will vote Oct. 18 on the issue of bonds for installing a water works system. J. D. King, mayor.

Tecumseh, Neb.—The improvement of the water service and the construction of a concrete reservoir is contemplated.

Dewey, Okla.—Plans and specifications for constructing a new water works system have been submitted, but council has

decided that test wells should be put down before approving them.

Dunkirk, Ind.—Bids will be secured soon for constructing a water works system. Chas. Brossman, engr., Indianapolis.

Ballinger, Tex.—Will vote Oct. 16 on the issue of bonds for the extension of the water mains and other improvements.

Georgetown, Tex.—Will vote Oct. 17 on the issue of bonds for the purchase and improvement of the present water and light plant.

Urbana, O.—The citizens petitioned council to purchase the present water works plant for $100,660, or build a new municipal plant.

Denver, Colo.—This city voted to issue $8,000,000 for constructing a municipal water plant. John B. Hunter, ch. engr. B. P. W.

Owensboro, Ky.—The city council has appropriated $20,000 for constructing a water softening plant for the city water works.

Corning, Cal.—An ordinance has been adopted to issue bonds for constructing water works and sewerage systems. F. E. Kenney, mayor.

Oriskany Falls, N. Y.—This village voted Sept. 6, to authorize the board of trustees to establish a gravity system of water works.

East Aurora, N. Y.—Voted to issue $18,000 bonds to extend the water mains and improve the pumping station. Vil. prest. Brotherhood.

Maxwell, N. M.—Special.—The Maxwell Irrigated Land Co. desires to purchase about 2.5 mis. of water pipe line, probably 6 or 8 ins.

Lordsburg, Cal.—Special.—A municipal water system will be installed at a cost of $36,000. Olmstead & Gillelen, engrs., Los Angeles.

Fairmount, W. Va.—Plans for constructing a water works system to supply water to the hilltop residents of this city are being prepared.

McLeansboro, Ill.—Plans and specifications have been submitted for a reservoir and water works system. The question will be voted on about Nov. 1.

Pittsburg, Kan.—Suit has been filed in the United States district court in Ft. Scott to enjoin this city from issuing bonds for building a new water works system.

Centerville, Mich.—Plans are being prepared for a new water works and electric light plant for the Centerville Water & Lgt. Co. F. W. Thomas, secy., 1919 Monroe st., Toledo, O.

Minneapolis, Minn.—The water works committee has recommended the purchase of 3 pumps, in accordance with the supplementary report submitted by E. B. Burch, hydraulic engineer.

Salt Lake City, Utah.—Geo. F. McGonagle, cy. engr., has plans prepared for constructing 19,000 ft. of 18-in. north branch water mains. The work will probably not begin until next spring.

Denison, Tex.—Special.—W. W. Berry, supt. water dept., says this city will vote on the issue of $50,000 water works bonds, Oct. 8, for constructing a pipe line and pumping station.

CONTRACTS TO BE LET.

Audubon, Ia.—Bids are asked until Oct. 3 for constructing a stand pipe. R. C. Spencer, mayor.

Oroville, Wash.—Bids are asked until Oct. 17 for constructing a water system. E. S. Taylor, town clk.

Alva, Okla.—Bids are asked until Oct. 4 for constructing a steel water tank. A K. Hubbard, cy. engr.

Ocheyedan, Ia.—Bids are asked until Oct. 5 for constructing a water works system. E. J. Parrott, cy. clk.

Decatur, Neb.—Bids are asked until Oct. 10 for constructing a water works system. Geo. F. Morley, cy. clk.

Victoria, B. C.—Bids are asked until Oct. 24 for brass goods, galvanized fittings, lead pipe, and galvanized iron pipe.

Tama, Ia.—Bids are asked until Oct. 3 for furnishing a centrifugal pump. C. A. Baughman, cons. engr., Ames, Ia.

Lakeland, Fla.—Bids are asked until Nov. 1 for improvements to the water and light plant. H. L. Swatte, cy. clk.

Oconomowoc, Wis.—Bids are asked until Oct. 3 for drilling a 16-in. well, 800 to 1,000 ft. deep. Clarence Schoemke, cy. clk.

Jacksonville, Fla.—Bids are asked until Oct. 4 for constructing a reinforced concrete reservoir. R. N. Ellis, supt. w. w.

Bradley, S. D.—Bids are asked until Oct. 5 for constructing a water works system. S. R. Caldwell, chm. bd. town trustees.

Cleveland Heights, O.—Bids are asked until Oct. 11 for constructing 8, 6 and 4-in. water mains in Noble road. H. H. Canfield, vil. clk.

Euclid, O.—Sealed bids are asked until Oct. 24 for constructing 12 and 16-in. water mains in Crosby ave. Nelson J. Brewer, vil. clk.

Tomah, Wis.—Bids are asked until Oct. 4 for constructing 3,700 ft. of 4-in. and 40 ft. of 6-in. c. i. water pipe and appurtenances. Cy. clk.

Chicago, Ill.—Bids are asked until Oct. 5 for constructing water service pipes in a large number of streets. Albert F. Keeney, prest. bd. local impvts.

Salt Lake City, Utah.—Sealed bids are asked until Oct. 7 for constructing 17,200 ft. of 18-in. and 500 ft. of 20-in. c. i. water main in City Creek Canyon. H. G. McMillen, chm. B. P. W.

Binghamton, N. Y.—Bids are asked until Nov. 1 for constructing a distribution reservoir, involving about 2,900 cu. yds. of plain and reinforced concrete. John D. Davidson, secy. bd. water comrs.

CONTRACTS AWARDED.

Chisholm, Minn.—The American Bridge Co. was awarded the contract for constructing 2 settling basins, for $14,000.

Conway, Ark.—The contract for constructing a water works system was awarded to Joseph McCoppin, of Little Rock, for $56,876.35.

Eveleth, Minn.—The contract for constructing new water pipes in central division No. 2 was awarded to Pastoret & Lawrence, of Duluth, for $9,000.

Hamburg, Ark.—The contract for constructing a water works and electric light plant has been awarded to W. J. Kennedy, of St. Louis, for $27,000.

Las Vegas, N. Mex.—M. M. Sundt has been awarded a contract for constructing an immense storage reservoir in the Peterson Canon, for $75,000 to $100,000, for the Aqua Pura Co.

Albany, N. Y.—The contract for constructing a reservoir and dam on the West Canada Creek at Hinckley was awarded to the Buffalo Dredging Co., of Buffalo, for $963,415.

Spokane, Wash.—The contract for constructing 79,500 ft. of kalamein pipe to be laid to Cannondale and Lidgerwood, was awarded to the Holly-Mason Hardware Co., for $59,445.

Port Clinton, O.—Special.—Bids for constructing a filtration plant were submitted Sept. 22, as follows: Norwood Engineering Co., Florence, Mass., $27,565; Roberts Filter Mfg. Co., $27,625; Doersbach Bros., Sandusky, O., $25,759; Pittsburg Filter Mfg. Co., Pittsburg, Pa., $26,500.

Pella, Ia.—Special.—A contract was awarded, Sept. 6, for constructing a combined water and light plant, as follows:

Des Moines Bridge and Iron Co., laying 18,500 feet of 10-in. pipe, $9,269; Des Moines Bridge and Iron Co., furnishing valves, hydrants and specals, $1,150; Des Moines Bridge and Iron Co., constructing filter gallery, well and pump house, $8,600; K. A. Verhey, constructing power house, $6,930; Des Moines Bridge and Iron Co., furnishing lead and jute, $1,500; Jos. E. Bortenlanger, Omaha, Neb., furnishing engines, boilers, generators, motors and all electrical apparatus, $21,652; Jos. E. Bortenlanger, furnishing two Triplex pumps, $3,590; Jos. E. Bortenlanger, 3½ miles transmission line, $3,750; Jos. E. Bortenlanger, city lighting lines complete, $10,152; Jos. E. Bortenlanger, secondary wiring, $3,500; U. S. Cast Iron Pipe and Foundry Co., pipe at $24 per ton, $15,625; total, $85,178. Murray Corliss engine, Ideal high speed engine, Murray boilers and Westinghouse generators and motors will be used. Iowa Engineering Co., Clinton, Iowa, engineers.

BRIDGES.

Salem, Ind.—Bids are asked until Oct. 3 for bridge repairs. Jos. W. Elrod, chm. co. comrs.

Rushville, Ind.—Bids are asked until Oct. 4 for constructing 3 bridges. J. N. Stone, co. audt.

Marion, Ind.—Bids are asked until Oct. 4 for constructing 8 concrete arches. A. Y. Stout, co. audt.

Lebanon, Ind.—Bids are asked until Oct. 9 for constructing 2 bridges. B. F. Herdrich, co. audt.

Philadelphia, Pa.—Bids are asked until Oct. 11 for constructing bridge, etc. W. Hunter, ch. engr.

Newport, Ind.—Bids are asked until Oct. 3 for constructing 2 bridges. H. T. Payne, co. audt.

Gothenburg, Neb.—Bids are asked until Oct. 8 for constructing a bridge across Platte river. Co. clk.

Washington, D. C.—Bids are asked until Oct. 3 for constructing several bridges. Thos. Nugent, co audt.

Petersburg, Ind.—Bids are asked until Oct. 4 for constructing 4 steel bridges. F. R. Bilderback, co. audt.

Greenfield, Ind.—Bids are asked until Oct. 3 for bridge repairs and construction work. C. H. Troy, co. audt.

Crown Point, Ind.—Bids are asked until Oct. 3 for constructing a bridge on Pulver road. C. A. Johnson, co. audt.

Waukesha, Wis.—Bids are asked until Oct. 3 for constructing a reinforced concrete girder bridge. M. R. Butler, cy. engr.

Martinsville, Ind.—Bids are asked until Oct. 6 for constructing 2 concrete arches. B. E. Thornburgh, co. audt.

Oswego, Kan.—Bids are asked until Oct. 3 for constructing 2 reinforced concrete arch bridges. W. A. Blair, co. clk.

Zanesville, O.—Bids are asked until Oct. 3 for constructing a bridge across Muskingum river at Fifth st. H. A. Buerhaus, co. audt.

Zanesville, O.—Bids are asked until Oct. 5 for constructing a concrete bridge on Cleague road. John F. Goldenbogen, clk. co. comrs.

Cincinnati, O.—Bids are asked until Oct. 14 for constructing a concrete bridge on Cleves and Warsaw pike. Stanley Struble, prest. co. comrs.

Shelbyville, Ind.—Bids are asked until Oct. 3 for constructing a concrete breakwater and a concrete steel culvert. G. B. Huntington, co. audt.

Winnipeg, Man.—Bids are asked until Oct. 8 for constructing a steel bridge about 1 mi. northeast of Cartwright. John B. Laughlin, clk. dept. pub. wks.

Allentown, Pa.—Bids are asked until Oct. 3 for constructing a steel girder bridge over Ontelaunee Creek, near Jacksonville. A. E. Bittner, chm. co. comrs.

Norristown, Pa.—Bids are asked until Oct. 11 for constructing a stone arch highway bridge over the northeast branch of Perkiomen Creek. Jas. Krewson, chm. co. comrs.

St. Joseph, Mo.—Bids are asked until Oct. 15 for constructing a viaduct or subway on S. Sixth st., across the railroad tracks of the Union Passenger Station in St. Joseph. Alfred Meier, prest. B. P. W.

STREET LIGHTING.

Marion, Ind.—The construction of a municipal light plant is contemplated.

St. Charles, Mich.—Voted to issue bonds for constructing an electric light and water plant.

Terre Haute, Ind.—An ordinance has been introduced for the establishment of a municipal electric light plant.

Binghamton, N. Y.—Will vote on the question of constructing a municipal lighting plant. John P. Irving, mayor.

Kansas City, Mo.—The Kansas City Missouri Gas Co. voted an appropriation of $400,000 to build an emergency gas tank.

Allentown, N. J.—Bids are asked until Oct. 10 for constructing a municipal electric lighting plant. A. Robinson, mayor.

Lakeland, Fla.—Bids are asked until Nov. 1 for extensions and improvements to the electric light and water plants. H. L. Swatts, cy. clk.

Missoula, Mont.—Bids are asked until Nov. 20 for constructing a power plant on Rock Creek at Stevensville. E. S. Dorman, ch. engr., Rock Creek Power Co.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Boston, Mass.—Bids are asked until Oct. 17 for disposal of refuse for 10 yrs. L. K. Rourke, supt. sts.

Jersey City, N. J.—Bids are asked until Oct. 10 for the removal of ashes, garbage and kitchen refuse for 1 yr. G. T. Bouton, clk. bd. st. and water comrs.

Kansas City, Kan.—A municipal incinerating plant for the disposal of garbage is urged by the Council of Clubs, which is composed of all the women's clubs in this city.

PARKS.

Palestine, Tex.—This city voted to issue bonds for the purchase of 2 parks.

Newaygo, Mich.—The site of the old court house will soon be converted into a city park, to be known as Brooks Park.

FIRE APPARATUS.

Rock Island, Ill.—The contract for installing a modern fire alarm system was awarded to Gamewell Fire Alarm Telegraph Co. of New York City for $11,256.

Hempstead, Tex.—W. P. Herms, B. Schwarz and others have been appointed a committee to purchase new fire equipment.

Waukegan, Ill.—Will vote Oct. 13 on issue of $35,000 bonds for erecting and equipping a new central fire station and a south side station.

Municipal Engineering

VOLUME XXXIX NOVEMBER, NINETEEN HUNDRED TEN NUMBER FIVE

The Seventeenth Convention of the American Society of Municipal Improvement

FOLLOWING its usual custom MUNICIPAL ENGINEERING devotes a large space this month to the proceedings of the Erie convention of the American Society of Municipal Improvements. This is done the more willingly because the number of practical papers offering definite information which helps in the solution of municipal problems is even greater than usual. In the light of the fact that this society has always been a society of good work, this is high commendation of this particular convention.

President Kendrick called the convention to order promptly according to program for a brief and hearty welcome from Mayor Liebel, who gave some interesting and valuable data regarding the history, the present condition and the prospects of the city and paid a well deserved tribute to the city engineer, B. E. Briggs. The president's address was devoted largely to the Pacific Northwest in which he has recently spent much time, and he made a suggestion that local branches be established in districts so inaccessible to the regular meetings of the society. The secretary and treasurer reported satisfactory financial conditions and over 30 new members admitted during the year, making the total more than 300. The afternoon session in common with the later sessions followed the program printed in the October number of MUNICIPAL ENGINEERING, with the addition of a paper by City Engineer C. H. Rust on sewage disposal for Toronto. Mr. O'Neil's paper on the construction of exposed sewers at Leavenworth, Kan., is presented this month. Others will follow later.

The discussion of Mr. Rust's paper brought out the growing dissatisfaction with the sufficiency of the septic tank, and the necessity of designing a system for the local conditions. It also emphasized the position taken some years since by MUNICIPAL ENGINEERING, in common with many experienced engineers, that the degree of purification to be demanded from the sewage disposal plant is dependent upon the rapidity of the purification possible in the body of water into which the sewage is discharged. This depends upon the quantity of water, the oxygen contained, the conditions of flow, and the like, and true economy as well as sanitary safety demand that the degree of purity attained by the disposal plant shall suit the local conditions, concerning which no hard and fast rule can be laid down. This is a point which State Boards of Health have been disposed to miss, especially when their technical advisers have been men with insufficient experience to be able to judge each case upon its merits and so have fallen back upon rules made undoubtedly safe from the sanitary point of view, without reference to the economics of the problem. The committee on sewerage and sanitation promised for next year a tabular summary of the principal sewage disposal plants in the country.

The evening session was filled with papers and lectures illustrated by the stereopticon, the most notable being by Rudolph Hering, showing European sewage disposal works, more particularly those which are reducing the sludge problem to manageable proportions, partly by reducing the amount and partly by rendering it entirely innocuous. The lecture was not written and a report would require the photographs, which could not be procured in time for this report.

City Engineer Clark G. Anderson, of Moline, Ill., presented a paper on the co-relation of sidewalk grades to curb grades, which is reproduced herewith, and reduces some of the problems in this line to definite form and offers some excellent solutions for them. A talk on laying asphalt with a surface heater, for which moving pictures had been promised, turned out

to be an advertising speech with a few lantern slides, during the progress of which the speaker was called to order. This occurrence, together with one or two later of similar nature led to a discussion of the subject of associate membership and the relations of associates to the programs of the society, which should result in a closer drawing of lines in the programs and in the discussions of papers.

FRED GIDDINGS, PRESIDENT,
Atchison, Kan.

Another illustrated paper by J. E. Putnam, assistant city engineer, went to show some examples of street lighting in Rochester, N. Y.

The morning session of the second day was quite full and carried two papers in addition to those on the regular program; one on the economics of modern highway engineering by Prof. Arthur H. Blanchard, of Brown University, Providence, R. I., and one on asphalt repair by City Engineer Henry C. Allen, of Syracuse, N. Y.

The paper by Mr. Kingsley, of Little Rock, on "Bituminous Pavements, Patented and Otherwise" created considerable stir being largely a protest against the court decisions upon the validity of the bitulithic patents. Mr. George C. Warren, president of Warren Brothers Company, made a comprehensive impromptu reply to the protest which, after all, can be of little practical avail unless it is made to the courts having the cases under consideration. The paper and Mr. Warren's reply are given herewith as fully as the limitations of space permit, that both sides may be considered together. The general conclusion seems to be that there are certain pavements in use which are somewhat similar to the bitulithic pavements, though lacking in strict adherence to the principles upon which the bitulithic patents rest, and that such pavements are not subject to royalties for patents, and that Mr. Warren does not object to the use of these pavements, but objects only to their misclassification as bitulithic pavements. This stand appeared to be justified by the samples shown, which, with but one or two exceptions, showed a bituminous macadam base with a bituminous mortar wearing surface. The exceptions noted did not show the bituminous mortar surface and one of them was apparently a complete mixture of the bituminous concrete base and mortar top in a single homogeneous layer. Whether this single layer could be classed as bituiithic would apparently depend upon whether the sample would show by analysis the selection of sizes to produce the minimum of voids and other characteristics which the bitulithic patent prescribes. The writer had several discussions on the subject with Mr. Fred J. Warren, the inventor of the pavement, and is disposed to think that Mr. Warren did conceive the idea of the bitulithic pavement on account of his experience with Denver pavements, to some of which Mr. Kingsley refers in his paper, but that the bitulithic pavement as formulated by him differs materially from the Denver pavements in that the latter only by chance and therefore very seldom approach the essential condition of the former, namely, a selection of certain sizes of stone which reduces the voids in the mass to a practical minimum. It is of course more expensive for cities to use forms of pavement while subject to royalty for patents than after the patents have expired, but this is the result of the desire to encourage inventive genius by giving it an opportunity to secure financial returns for its activity and is not to condemn that genius nor to subject it to condemnation on account of the workings of the patent law. The practical value of the paper lies in the attention which it calls to substitutes

for bitulithic which are not included under the specifications of the patents. These pavements may be studied and adopted if found satisfactory.

Some of the work set for the second morning was carried over to the third morning and to it were added two papers on supervision of municipal work by W. P. Blair, of Indianapolis, and on the pavements of Erie by Assistant City Engineer F. G. Lynch.

The sub-committees of the general committee on standard specifications seemed to be sadly confused by misunderstandings and mis-information, but four reports were finally presented as progress reports, prepared mainly by the chairman of the committees, and were placed on file for further consideration by the general committee. The status of the general committee was finally stated and it was made a standing committee of the society with power to appoint sub-committees upon special subjects, its field to cover all kinds of specifications in use in municipal work. Mr. Linn White of Chicago, presented a verbal report on bituminous paving nomenclature, stating that the American Society for Testing Materials is at work upon the question and a report would best be made after joint consideration. Mr. A. W. Dow for the committee on wooden blocks and Mr. F. P. Smith for the committee on asphalt paving specifications presented the specifications adopted by the Organization of City Officials for Standardizing Paving Specifications with some modifications deemed by them essential or desirable. Mr. E. H. Christ presented for the committee on brick specifications a brief progress report and a resolution, which was adopted, asking the National Paving Brick Manufacturers to express itself regarding a specification for standard sizes of bricks and blocks for street paving.

The association listened to a most interesting history of the progress of the work of devising a standard rattler for testing paving brick, given by Professor Edward Orton, of Ohio State University at Columbus, who is at work in his laboratory upon the matter for the National Association of Paving Brick Manufacturers, in conjunction and in parallel with Marion W. Blair, at Indianapolis, in the laboratory of the association. The difficulties that have been overcome, the present form of staves for the rattler and the program of tests to determine the best specifications for staves, shot, etc., were clearly and concisely set forth and, doubtless for the first time for most of those present, were put in shape for easy comprehension.

All of these reports will be given due space in MUNICIPAL ENGINEERING later.

The program of the third morning was transferred bodily to Friday, the fourth morning of the convention and was presented in full with but one or two exceptions.

E. A. KINGSLEY, VICE-PRESIDENT,
Little Rock, Ark.

The entertainment features were almost too lavish. Wednesday afternoon was spent on the bay, at the water works settling basins, the life-saving station, etc., and dinner was taken at the Country Club. This was so enjoyable, with the after-dinner speeches, that the evening session was omitted ,except the necessary election of officers. Thursday afternoon was given to automobile rides over the excellent streets of the city, which show the effects of an efficient system of street repair. The evening was spent socially, many attending a vaudeville entertainment as guests of the local committee. These two large breaks in the business program resulted in many desertions and, while the attendance during the first two days was large, that on the last day was very small. The ladies' committee headed

by Mrs. Briggs was indefatigable, and the visiting wives and daughters of members were strong in their commendation of the entertainment given them.

The exhibit feature was not quite so prominent as for the past year or two but was very interesting and instructive. The exhibitors were as follows:

Warren Brothers Company, Boston, Mass., represented by George C. Warren, president; G. M. Ingram and E. M. Robinson, of the Southern Bitulithic Co., Nashville, Tenn.; C. E. Kennedy, of Utica, N. Y. A notable feature in their exhibit was a table showing the increase in bitulithic contracts per year from 16,400 square yards in 1901 to 3,477,654 in 1910, equal to 800 miles of 30-foot roadway.

The Texas Company, represented by Harry Tipper, publicity engineer, New York, with paving cement, road oils and asphalts.

The Barrett Manufacturing Co., represented by James F. Ball and H. E. Rosenhild, of Pittsburg, Pa., with pitch fillers for pavements.

The St. Marys Sewer Pipe Co., St. Marys, Pa., with sewer pipe and fire clay goods.

The Union Clay Products Co., represented by A. L. Gillespie, president, and W. W. Dixon, 50 Church street, New York with a new joint filler for making water-tight sewer joints, a demonstration of the method of using being made on Thursday morning.

The American Asphaltum and Rubber Co., represented by Thomas M. Roche, 600 Harvester Bldg., Chicago, Ill., with Pioneer filler asphalt for brick and block pavements.

Walter C. Parmley, Everett Bldg., New York, with his system of reinforced concrete constructions for sewers, conduits, manholes, tunnels, etc.

The Lock Joint Pipe Co., represented by Coleman Meriwether president, and A. M. Hirsch, treasurer, 165 Broadway, New York, and B. F. Granger, Jackson, Mich., with their continuous reinforced concrete pipe.

The Dunn Wire-Cut Lug Brick Co., represented by F. B. Dunn, secretary, Conneaut, O., with his wire-cut lug brick, which was also used in the demonstration of the proper method of laying brick pavement with cement mortar filler.

The Standard Asphalt and Rubber Co., represented by J. F. McGuirk and H. B. Fisk, 205 La Salle street, Chicago, Ill., with filler for brick and block streets and pipe dip.

The National Paving Brick Manufacturers Association, represented by Will P. Blair, secretary, Marion W. Blair, Merle Sidener, Indianapolis, Prof. E. D. Rich, Ann Arbor, Mich., and W. T. Blackburn, Paris, Ill.

The Destructor Company, Power Specialty Co., manager, represented by Alexander Bradley, 111 Broadway, New York City, with booklet regarding their garbage destructors.

The Indian Refining Co., represented by A. B. Chamberlin, engineer, First National Bank Bldg., Cincinnati, O., with Indian asphalt binder for pavements using asphalt cement, asphalt road oil, heavy liquid asphalt for resurfacing old roads and emulsion oil for park purposes.

The Perry Iron Co., Erie, Pa., with slag for concrete, fireproofing, etc.

The Link-Belt Co., Chicago, with circulars regarding a portable asphalt paving plant.

Other representatives of business houses were: B. B. Colborne of the Equitable Asphalt Maintenance Co., Kansas City, Mo.; E. A. James of the *Canadian Engineer*, Toronto, Ont.; Dudley T. Corning of the Cambria Steel Co., Johnstown, Pa.; D. Warren de Rosay of the Corry Brick and Tile Co., Corry, Pa.; E. H. Goodrich of the Mack Manufacturing Co., Philadelphia, Pa.; H. L. Powell of *Good Roads*, New York City; H. B. Kirkland of *Engineering-Contracting*, Chicago, Ill.

The delegates present were the following:

Albany, Ga.: R. J. Edgerly, city engineer and superintendent construction.

Atchison, Kan.: Fred Giddings.

Auburn, N. Y.: J. Walter Ackerman, superintendent water works.

Birmingham, Ala.: Julian Kendrick; John M. McCartin, street commissioner; Maury Nicholson, city engineer.

Canton, O.: Phil H. Weber, city engineer.

Chicago, Ill.: Linn White, chief engineer South Park Commission.

Columbus, Ga.: W. C. Campbell, superintendent public works.

Columbus, O.: A. Winthrop Pratt, chief engineer State Board of Health.

Concord, N. H.: Alfred Clark.

Dallas, Tex.: E. L. Dalton.

Dayton, O.: F. J. Cellarius, city engineer.

Daytona, Fla.: D. D. Rogers, city engineer.

East Orange, N. J.: Fred A. Reimer, city engineer.

Erie, Pa.: Ben E. Briggs, city engineer; A. S. Pinney, city treasurer; Faulkner G. Lynch, deputy city engineer; Jesse Supplee; Miles R. Nason, councilman; J. H. Careaghan; F. E. Delano.

Grand Rapids, Mich.: L. D. Cutcheon; Edward H. Christ, Board of Public Works.

Hamilton, Ont.: Job Brennan, A. F. McCallum.

Indianapolis, Ind.: Charles Carroll Brown, consulting engineer and editor MUNICIPAL ENGINEERING.

Little Rock, Ark.: E. A. Kingsley, superintendent public works.

Meadville,, Pa.: B. F. Miller, Jr. city engineer.

Moline, Ill.: Clark G. Anderson, city engineer.

Montclair, N. J.: James Owen, county engineer; M. N. Baker, president Board of Health and editor of *Engineering News*.

Newark, N. J.: A. F. Eggers, A. R. Denman, Wm. Mungle, H. B. O'Connell, Board of Public Works; C. V. Baumann, John B. Stobaeus, Board of Trade; E. S. Rankin, engineer sewer department; Wm. A. Howell, engineer street department; J. C. Hallock, assistant to chief engineer; M. R. Sherrerd, chief engineer; Lee Ottolinger, president, Wm. A. Baker, vice president, Market Street Business Men's Improvement Association; Wm. Rankin, engineer sewers.

Niagara Falls, N. Y.: R. A. McClanathan, city engineer.

New York, N. Y.: A. W. Dow and Francis T. Smith, chemical engineers on paving; C. D. Pollock, assistant engineer of highways: Rudolph Hering and George W. Fuller, consulting engineers; James H. Van Buren; J. W. Howard, consulting engineer; A. Prescott Folwell, secretary.

Oil City, Pa.: G. F. Roess, city engineer.

Pawtucket, R. I.: George A. Carpenter, city engineer.

Pittsburg, Pa.: C. F. Taylor; Chas. M. Reppert, engineer, N. S. Sprague, superintendent, bureau of construction.

Rochester, N. Y.: E. A. Fisher, city engineer; J. E. Putnam, assistant city engineer.

Syracuse, N. Y.: Henry C. Allen, city engineer.

Toronto, Ont.: C. H. Rust, city engineer; D. Chisholm, alderman.

Troy, N. Y.: E. L. Grimes, city engineer.

Wichita, Kan.: Bert C. Wills.

Wilmington, Del.: L. V. Christy, Alex. J. Taylor, Frank W. Pierson, Chas. A. Rudolph, George W. Sparks.

Winnipeg, Man.: H. N. Ruttan, city engineer.

The officers elected were: Fred Giddings, Atchison, Kan., president; E. A. Kingsley, Little Rock, Ark., first vice president; Ben. E. Briggs, Erie, Pa., second vice president; Edward H. Christ, Grand Rapids, Mich., third vice president; A. Prescott Folwell, New York City, secretary; E. S. Rankin, Newark, N. J., treasurer.

The next meeting of the association will be held in Grand Rapids, Mich., probably in October 1911.

Exposed Sewers at Leavenworth, Kan.*

By Joseph O'Neil, City Engineer

IN designing main trunk and lateral sewers for sanitary sewer district Number Nine at Leavenworth, the latitude of the design was limited by a great many natural conditions. The district consists of several minor drainage areas and contains numerous creeks and "draws," making the topography of the district very rough and broken. At points where creeks cross alleys and streets, are located culverts and bridges, the crossing of which controlled the grades of the sewers almost absolutely. In addition to this, the several additions to the city comprising the district were poorly platted when originally laid out, and the arrangement of strets and alleys is bad; in some cases there are two and three alleys in one block, platted as "T" and "H" alleys; in other cases there are no alleys, and it was necessary to condemn right-of-way for sewers. In order to lay out the main trunk sewer so as to provide for lateral sewers in each block, the alignment was controlled entirely by these requirements, and the topography had to be disregarded for the most part.

Being thus controlled in grade and alignment, the depth varied from very shallow to exceedingly deep work, sometimes through twelve or fifteen feet of rock. In crossing creeks and ravines, it was often necessary to have the sewer above ground. These "exposed" sewers will be discussed in this paper.

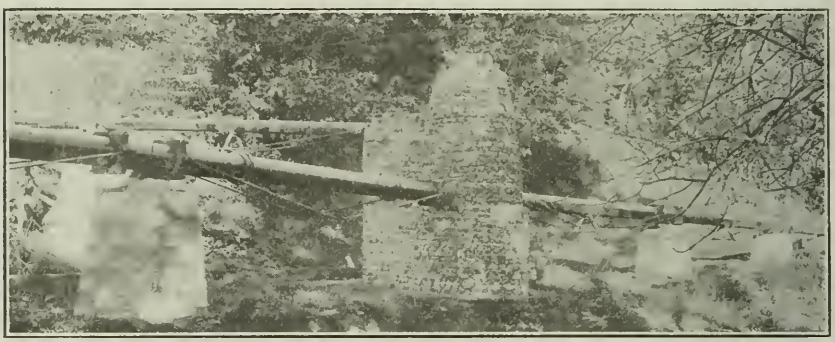
*A paper before the American Society of Municipal Improvement.

It was deemed best to use light weight, bell and spigot cast iron pipe supported on concrete piers, and to provide for the free expansion of the pipe. To attain this end, it was provided that the piers be mounted with cast iron pier plates anchored into the concrete; on these plates were to be placed several lengths of round bar iron at right angles to the line of the sewer, to serve as rollers; and fitting over the top of the plate and rollers in such a manner as to secure the rollers from falling out, but at the same time to permit them to roll on the plate with the expansion and contraction of the pipe, a saddle to fit the outside diameter of the pipe.

To avoid placing piers in creek channels where they would obstruct the flow, it was necessary to get a wider panel than twelve feet, and a truss was designed to support the intermediate joint. The truss consists of clamp bands to fit the circumference of the pipe and hold the truss rods in place, a queen post and a set of rods as shown on the photograph. In estimating the cost of the work, it was found that the complete truss was less expensive than the pier with its necessary castings, so it was decided to make the panels twenty-four feet instead of twelve feet, and to use a truss between each set of piers. To provide further for expansion, it was decided in cases where there was more than seventy-five feet of exposed pipe in a span to place an expansion joint. The regular type of iron body, brass sleeve expansion joint was specified.

While the expansion in an iron pipe with a flow of sewage would be very small, owing to the almost constant temperature of the sewage, and might be taken care of by the "giving" of the lead in the joints, at the same time the loosening of the lead from expansion and contraction would cause leaks that would require attention later on, and it was considered necessary to install expansion joints.

In designing the special castings required for this work, every effort was made to have them simple, yet strong. To provide for different sizes of pipe, bushings were used where possible, or one casting only of a set was altered. This reduced the number of patterns required for the castings and kept the castings standard as far as possible. The castings required for the work were made by local foundries.



EXPOSED IRON PIPE SEWERS, LEAVENWORTH, KAN.

The unit contract price for this class of work were as follows:

10-in. light weight cast iron pipe in place, per ft	$1.50
8-in. light weight cast iron pipe in place, per ft	1.00
Trusses for 10-in. pipe complete and in place, each	16.50
Trusses for 8-in. pipe complete and in place, each	18.00
10-inch expansion joints complete and in place, each	55.00
8-inch expansion joints complete and in place, each	45.00
Concrete piers 5-ft. high or under, fully equipped with castings, each	22.00
Additional height of piers, per vertical ft	3.00

The accompanying photograph shows a section of exposed sewer and a drop manhole entirely above ground, a complication arising from the conditions before mentioned.

The Present Use of the Septic Tank*

By Prof. Henry N. Ogden, Cornell University, Ithaca, N. Y.

IN 1896, Mr. Donald Cameron, City Engineer of Exeter, England, with two others, was granted patent rights in an apparatus or invention for the purpose of dealing with crude sewage bacteriologically and bringing it into such a condition of solution and liquefaction that it could be thereafter more easily treated by filtration or irrigation or any other suitable way. Before that time, tanks of various kinds had been in use not only in England but in other countries. For twenty-five years previously, chemical treatment had been the prominent method of eliminating from sewage the suspended matters which had been found to be troublesome, both on irrigation fields and in rivers and tidal estuaries. The bane of every superintendent in charge of a sewage disposal plant has always been the vast accumulation of sludge, which is generally produced faster than the land available can take care of it; and which does not readily lend itself to any other method of disposal. There was no great difficulty in purifying the liquid part of the sewage sufficiently so that it could be discharged into streams after the solids were removed, but to dispose of the solids, that was the trouble.

The value of Mr. Cameron's invention, the feature of his scheme which appealed to the city officials generally, was contained in this statement—"By this invention it is possible to get rid of the sludge difficulty because the sludge portion of crude sewage is entirely thrown into solution." His claim was based on experiments made in Exeter on a small tank 12 feet wide, 15 feet long and 2½ feet deep, and was expressed as above after seven months' operation. Since that time much has been learned about the operation of sewage tanks, generally dignified by the name of septic, and the recent lawsuits over the patent rights involved, as well as the papers before learned societies, have produced evidence and discussion covering not merely every detail of construction and operation of the tank, but even its very name. Engineers have considered the length of time during which sewage should remain in septic tanks, and many experiments have been made in order to arrive at some definite conclusion. There has also been a large amount of testimony presented from various parts of the world on the action taking place during the passage of sewage through the tank. That gases of various kinds were developed by this action was easily discovered, and one of the advantages at first claimed for this treatment was that the production of those gases would be a source of revenue to the municipality, replacing, to a large extent, the ordinary illuminating gas.

During the fifteen years since the patent was issued, many of the claims which originally were made for the invention have been disproved, and more extended and scientific experiments on septic action have been made. Further than this, experiments and experience both have combined to establish certain definite appreciations regarding its value, and it may not be out of place here to summarize, briefly, just what a septic tank may be expected to do and just what we know it will not do.

In the first place, we know definitely that it will neither purify sewage completely nor act as a panacea in eliminating sludge. Not long ago the writer was much interested in the enthusiasm of a western salesman who was dealing in plumbing specialties. He had found that, in order to secure sales, he must be prepared to advise customers on the subject of sewage disposal, and he was spreading broadcast recommendations, vouched for by himself as facts, to the effect that the installation of septic tanks would transform sewage of any degree of pollution into what, if not drinking water, might be considered equal to the quality of the average river. This is not true, and no one who has followed the experiments on tanks believes it to be true.

Nor does the septic tank do what Mr. Cameron thought it did, namely, eliminate the sludge difficulty. Inasmuch as the septic tank is, after all, a tank, there is inevitably brought about a certain sedimentation so that the liquid passing out of the tank is usually freed from a certain amount of suspended matter. To this extent the sewage is purified, and if filtration follows, the surface of the filter and possibly the interior of the filter is relieved of the usual clogging.

*A paper before the American Society of Municipal Improvement.

It was at first thought that the liquid, carrying material in solution, was itself affected by septic action and that certain anaerobic changes taking place in the liquid were desirable as being necessarily preliminary to later filtration. The English chemists and biologists have been inclined to cling to this idea and to divide all bacterial processes of purification into two parts, namely, one occurring in the septic tank, where liquefying and anaerobic bacteria should transform the crude organic substances into ammonias and nitrites, the other the aerobic filter bed, where these organic matters already started on the road to purification might be fully nitrified. The Massachusetts State Board of Health pointed out ten years ago that this theory was not always tenable, since in their experiments it happened very often that no better results were obtained on filters dealing with septic sewage than filters dealing with crude sewage. Further than this, it was pointed out by them that if the action in the septic tank proceeded too far, subsequent filtration was thereby more difficult and less complete, and this belief has extended until to-day the original claim of Cameron has been almost forgotten and the fact that so far as the liquid portion of the sewage is concerned septic treatment is immaterial if not objectionable, has been fully substantiated.

What, then, does the septic tank accomplish? Simply this: It manages to exert an action upon the material which is settled out of the sewage as it passes through the tank, not to the extent of destroying it all, as Cameron claimed, but to the extent of liquefying or gasifying about one-third of those solids. It was, and still is, by some, believed that a septic tank never requires to be cleaned out; that in some mysterious way the bacteria destroy all the precipitating solids. This is far from being a fact, since no bacteria can act on mineral matter, of which some is always present in sewage; nor can they destroy the humus-like material into which the organic material is converted. There is inevitably in a septic tank an accumulation of solids proportionate in volume to the flow of the sewage, provided such solids are retained in the tank. One can be very sure that where such an accumulation does not take place the solids are being carried out of the tank by the flow of the sewage and are being deposited in a finely divided state on the surface of the filter beds, where they do more harm than if they had been carried out in their grosser and coarser condition.

The septic tank, then, is valuable in that it acts as a sedimentation tank, incidentally equalizing the flow of sewage, and in that it may eliminate about one-third of the precipitated solids. Unfortunately, if the flow of sewage through the tank is so slow as to permit the destructive action to reach its maximum effect, there has been found a resulting action in the liquid of the sewage which poisons it so that subsequent treatment of the sewage is made more difficult. The odors of the plant are always increased also if the septic action is pronounced. Therefore, the designer of the tank is almost at a loss to know whether the tank of small size, which minimizes the action on the liquid, or the large-sized tank, which emphasizes the action on the solids, is the more desirable. The most intelligent management to-day seems to tend toward the use of small tanks, through which the velocity is comparatively high and where sedimentation takes place, without, however, allowing room for any accumulated solids. Such tanks are made with inverted conical bottoms, at the vertex of which the deposited material is found. By connecting this vertex through a pipe with another tank at a slightly lower level, the solids may be drawn off into a special receptacle, where septic action may be continued on the solids alone as long as the capacity of the second tank allows.

In the Travis tank at Hampton this division of solid and liquid is accomplished by dividing the tank by a horizontal partition, so arranged as to leave a slit or opening between the sides of the tank and the partition. By means of two valves, one opening from below this partition and the other from above, the velocity of flow through the two parts is controlled, and it is managed so that the velocity through the upper part, comparatively free from suspended matter, is much greater than the velocity through the lower part, which contains the organic matter on which the tank is expected to act.

In those cases where continuous operation is claimed for a period of years without any accumulation of deposited material, one may be sure of finding in the effluent small black particles, which represent the inevitable loss of deposit to make up for the accumulation of new material. This fine material, as is generally the case with the solid matter acted on in the tank, is comparatively free from odor and may

be dealt with far more easily than the raw sludge, and this may be said to constitute another advantage of this tank treatment. Altogether, the value of the septic tank has been much modified since its invention, and inasmuch as the present feeling among engineers and managers is that septic sewage is not desirable for after-treatment, and that in every case a tank should be emptied of sludge at least once a month, provided subsequent filtration is practiced, the claims of the holders of the septic tank patent rights are not of as much interest as when the value of those patent rights was more highly considered.

Pollution of City Water Through Check Valves on Private Fire Protection Plants*

By J. Walter Ackerman, Superintendent of Water Works, Auburn, N. Y.

THE subject of possible contamination from polluted auxiliary or secondary water supplies used for fire protection through the check valves has received attention lately by both the New England Water Works and American Water Works Associations. And while there seems to be a division of opinion as to the advisability of having secondary supplies connected with the general system, its adherents admit that to meet sanitary requirements the check valves must be practically infallible in their operation. And when mere man attempts to make something in this class, he has mapped out for himself a fairly large sized contract.

Without in any way attempting to take sides in the matter of whether it is advisable to have the secondary supplies connected with the general city water system, I will discuss it solely from the point of its being connected, and the relations of the check valves thereto.

Generally speaking, I believe the papers before the societies of this character usually represent some item of the writer's experience. This is true in my own case, and a short sketch of that experience will better show you a reason for the development of the check valves in our system.

The city of Auburn, N. Y., is a town of about 36,000 inhabitants, and is situated in the Central New York lake district, on the outlet of the Owasco Lake. This lake has a drainage area of about two hundred square miles, and an impounding capacity of about two thousand million cubic feet available for power purposes; and the topography of the city is such that there is about two hundred feet fall in the outlet of the lake as it passes through the city, hence it furnishes good water power, and in the natural development of the town many mills and factories were built upon this stream, on account of its abundant water power privileges, so that it came to be a manufacturing city. Also, this same stream became the receptacle for the discharge of all the sewage in the city. So, you will note that for the ordinary secondary supply, most of the mills and factories secure it from this sewage polluted stream.

In the spring of 1908 there was a small epidemic of typhoid fever, and the Water Commissioners employed a sanitary expert to trace out the source of the same. But his report, rendered some months later, which showed evidence of careful research, did not show any positive proof of the source of the epidemic. But on account of the fact that no carrier was as common as the water supply, the probable cause of this epidemic was ordinarily laid to the city supply. Further investigation later, by other sanitary experts, failed to add any further information, and corroborated the first expert's opinion.

The writer assumed the duties of Superintendent of the Auburn Water Works in September of the same year, but was familiar with the situation, as he had served in the capacity of City Engineer for a period of six years. After being in office for a short time, it was learned that some of the men in the factories claimed that they did not like the drinking water after a fire drill. This led to an investigation, and it was found in this particular locality that while the secondary supply was not from an infected source, it was stagnant water, and the weekly fire drills would fill the fire lines full of this water, and the employees would

*A paper before the American Society of Municipal Improvement.

drink the same. This incident was the starting of an investigation of all the mills and factories, to learn if there was any chance for the polluted water of the secondary supplies reaching any of the operatives of the mill, or passing out into the main lines of the water works system.

In about a dozen of the factories that have secondary fire service equipment, the following is the general type:

In the street bordering the factory or mill site, the mains of the city distribution system, generally 12 inches in size, are located at a depth of about five feet underground; either at one or two points on this main, a connection is made from four to twelve inches in diameter, depending upon the amount of water needed for fire protection, proportionate to the size of the factory. Most of the original installations generally had an indicator post on the gate valve, which closed the leader running into the factory, but which was used only at such times as repairs were being made, as the efficiency of the system depended upon this valve being open at all times for immediate use. After the water passed through the above mentioned gate valve on its way to the factory, it next passed through a check valve, which was so placed as to allow the water to pass freely through it on the way to the factory, but which was supposed to close tightly if a current of water passed in the opposite direction back toward the city main.

The pressure for the supply of the city is furnished by pumps, and whenever a fire alarm is sounded, of which the pumping station gets the same alarm, the pumps are speeded up to increase the pressure for fire fighting purposes. The normal city pressure varies from fifty to ninety pounds, depending upon the locality; but in the district where the factories are located the lowest pressure is perhaps normally sixty, and the greatest about eighty-five. But at times of fire this pressure is increased about thirty pounds.

During the course of the investigation, it was found that the underwriter's pumps installed for giving an increased pressure and a secondary supply, at the factories, generally had their relief valves set from ten to fifteen pounds higher than the city fire pressure. When the examination of the check valves was started we found that usually they were all buried in the ground, the same as the water pipe and other similar specials, as gate valves, tees, etc., so that no inspection had ever been made of them since their installation, some of them having been in use nearly twenty years, although subsequent events did not seem to prove that a long installation gave any more leaks than those installed for shorter periods of time. But other factors entered into this which may have made the difference, viz: the older valves were of smaller sizes, and of different manufacture, than those of recent use.

The general installation, as before noted, was typical of all of the secondary supplies in the city, and I found that the insurance regulations required that the underwriters fire pump must be brought up to sufficient speed so that the relief would discharge; this to be done at least once each week.

On being present at these tests, the writer found that the pump taking its supply from the polluted river above mentioned would bring the entire factory supply system up to the pressure at which the relief of the pump was set. So, at the time of testing, all of the fire pipes and mains in the factory and factory yard were the same pressure as that created by the pump. At such a time this pressure would always be more than that carried by the city mains, consequently the water inside would tend to go out into the city main if the check valve did not properly operate to prevent it. At the time of an actual fire or an actual test of the entire system, as conducted by the insurance inspectors, the entire system is filled with polluted water, as the different hose conections in operation would soon empty the supply of city water stored in them, which would be replaced by the polluted water of the river. This, in turn, they would attempt to flush out by means of allowing the city water to then flow through the system after the pump had ceased operation.

In order to study the situation, the check valves were all exposed, and taps were inserted in the pipe lines between the check valves and the gate valve with the point indicator before mentioned. Then, by varying the pressure inside the factory, it could be determined whether water came back through the check, and out through this tap, with these variations in pressure. Many samples of water were collected. Some of these check valves seemed to close absolutely tight; but those that would close tight one day, did not seem to be tight the next, and vice versa. Generally speaking, however, the larger the check, the greater

the disposition to leak; and in some cases they were notoriously bad.

Bacterial examinations which were taken at this time showed polluted water going back through the check valve into the city main. After these examinations were concluded, Mr. George C. Whipple, of New York, who was making a complete sanitary report on the entire city system, was asked to examine the check valves, and look over the results already obtained. The result of his report was such that the Water Commissioners felt that contamination was liable to result from the continuance of the installation as then existing; and so all factory and mill connections were ordered discontinued if the secondary supply was to be used in connection thereto. This, of course, met with opposition on the part of the factory owners. And after appealing to the insurance interests, they recommended double check valves, in place of the ones previously used. This concededly better equipment was not endorsed however by the Commissioners, but critical examinations of these new double check valves showed that there were many points for improvement in design, as tuberculation of corroding surfaces was liable to cause the same condition of affairs as was found in the single valves. A hearing was given to the insurance and factory interests, and finally the entire matter was turned over to the Commissioners' experts and the insurance experts.

On receiving the report of this conference, the Commissioners modified the original order of discontinuance, and adopted a special design in double check valves submitted by the experts of the insurance interests.

As the situation now stands, these specially designed and constructed double check valves are installed on all fire service connections where secondary supplies are used, and placed in accessible brick or concrete pits, so that inspection may be made by agents of the Water Board, the factory owner to pay all such expenses, the normal test being a test for leakage, but at least every six months the valves are dismantled and examined to see if there is any chance for further improvement in design, or if they are in any way actually faulty under the present form.

Some of these double check valves have been installed for six months or more. Generally speaking, the difference between these valves and the original type is that in the present instance the clapper, the holding ring, the pin, the bushing and the seat are all made of bronze, and a rubber disc is used to make the same tight, this disc being made of a composition similar to that used in the Grinnell dry valve system. The cast iron body of the check valve is enlarged to such an extent that the space between the clapper and the walls is much larger than formerly, so that any of the tubercles forming upon the cast iron surfaces could not possibly reach out for enough to keep the check valve from operating.

One other condition is that the valves should be at least eighteen inches from center to center. This has the tendency of being far enough apart so that any stick which could travel in the pipe after it got into the same would be less liable to keep both of the valves open if it happened to stop at that place.

For testing the valves, three pressure gauges and two drips are employed. The first gauge is between the indicator post gate, which shuts off the supply from the city pressure, and the first check; the second gauge is between the checks; and the third gauge is beyond the checks. The first drip is between the indicator post gate above mentioned, and the first check; the second drip is between the checks. So that by the use of the above mentioned indicator post gate and the drips and the pressure gauges it can be determined whether there are any leaks in the check valves or not. The actual monthly inspections show that in general these checks are tight, although it is very rare in making the rounds, but what one or two will show a leak, and several times on examination of them, have failed to give any adequate clue to reasons therefor. Other times, small pieces of jute or other refuse have been found upon the seat or face of the valve. And it is very seldom but what these checks can be made to close tight by flushing them out with a quantity of water. But in some instances, this even fails. And today I have one or two checks which I cannot make close absolutely tight every time. However, at no time have I found two check valves in one line at one time which did not work. This, of course, shows the wisdom of using the two checks.

However much this improvement is over and above the old type, it is, I believe, more the accessibility and inspection that renders them so much more reliable than the older type. It would seem on examining one of these checks in its finished state, that it was almost impossible to make a better one, or that there were any chances for

improvement. And in the six months' experience which I have had in testing them, while they are not infallible,as you will note, still, there is no situation which has arisen which would call for any material change in the design. But I am still confronted with the fact that they are not all working correctly all the time. And it would seem that, notwithstanding all of the improvements, that the only safe way is a frequent test and examination to determine that they are in proper working order.

Sidewalk and Curb Grades*

By Clark G. Anderson, City Engineer, Moline, Ill.

UPON unimproved streets the sidewalk grade problem would appear as a very simple proposition of grades and their intersections. As soon as the roadway curb makes its appearance, or upon streets where the curbs are in place, the question of sidewalk grade comes forth with an astonishing variety of combinations, and especially so at street intersections.

As an illustration I might ask, "What should be the elevation of grade for the intersection of two walks at a corner from which one curb ascends at the rate of 4 per cent. with the walk 10 feet distant, and the other curb descends at the rate of 8 per cent., with the walk 4 feet distant from the curb?" In this particular case we will have one of two possible conditions: either the walk on one of the streets must be depressed below the curb on that street, thus draining the parking on to the walk, or, if the walk be raised so as to drain the parking to the curb, it will necessitate either steps or a very sharp incline to meet the conditions at the cross street.

The elements to consider in the establishing of sidewalk grades should be:

1. Service to the public.
2. Hazard to the municipality from the standpoint of personal injury damage suits.
3. Benefit and damage to the abutting property.
4. Beauty of the street.

In considering service to the public it is not sufficient to take account only of what the ordinary able-bodied person is capable of doing, or what the public is willing to tolerate, but honest effort should be given toward bringing the walks provided for pedestrians to such condition that the blind, lame, aged and women with children may travel along the same with reasonable assurance of safety and with the least effort.

Volume of traffic may enter into the question of service to the public, as excessive slopes, steps and other necessary devices that may be permitted on residential streets of limited extent and traffic, might prove hazardous, objectionable and intolerable on business streets.

Uniformity in general plan is also worthy of consideration, as man is more or less of an automaton in his actions. Provide one or two of the eight gutters at a street intersection with crossing plates, and you will find many people stumbling there, especially if the street light happens to be out of commission; or let a cross-walk drop on an excessive grade at such a place, and people will be continually slipping there, on the same principle that your foot will always discover the faulty riser in a flight of stairs.

The public at large is disposed to ignore the principle of law as applied to reasonable care to "stop, look and listen," and expect their servants to provide means of travel of such character that this principle need not be invoked by them. We say it is impossible, but many a costly judgment in personal injury suits could have been spared municipalities if a little more attention had been given these insignificant details.

In cities of rugged character, topographically, the question of damage or injury to the abutting property, due to determining sidewalk grades, and location of the walk as well, often becomes very troublesome. This is especially true on streets where retaining walls have been carelessly built to support terraces, or where buildings may exist close to the street line. Having found a happy reconciliation of utility, safety, damage, and beauty of the street, under such conditions the

*A paper before the American Society of Municipal Improvement.

engineer may well grin defiance at the most intricate problem in the higher mathematics.

No one may say, in these days of aesthetic endeavor, that the beauty of the street should be neglected for the sake of utility. But the engineer, having determined upon a reasonable compromise in the establishing of a difficult sidewalk grade, is rather disposed to say, with the fellow in prison for smiling at his neighbor's wife, "To perdition with beauty! See where it lands me!"

When other modifying conditions may be ignored, there are three combinations of circumstances under which hard and fast rules may be laid down for the relationship between sidewalk grade and curb grade, namely: where intersecting curbs approach a block corner on a level; where intersecting curbs approach a block corner on equal, or substantially equal, descending gradients, and where intersecting curbs approach a block corner on substantially equal ascending gradients. It is readily seen that there are three other combinations, namely: where a level curb intersects a curb on descending gradient; where a level curb intersects a curb on ascending gradient, and where a curb on ascending gradient intersects a curb on descending gradient, any or all of which conditions upset any fixed rule for this relationship. The three last named combinations are more frequently met with than are the three first named.

The first determinations to be made are, satisfactory transverse slope for the walk and desirable incline of the parking or that portion of the walk space between the walk and the curb. There is some difference of opinion among engineers as to what these slopes should be. As the writer is using one-quarter inch per foot, or the equivalent of 2.08 per cent., for transverse slope in the walk, and a minimum of one-half inch to the foot, or the equivalent of 4.17 per cent., for the slope of the parking on streets used for residential purposes, these figures will serve as well as any others for the purpose of illustration.

The only useful function of the transverse slope is to drain surface water to the street gutter. This will not be accomplished in the case of walks on level or low grades, using the figure given for minimum in the parking, unless the earth surface is left somewhat lower than the top of the walk, in case the parking is seeded, as the sod will form a mat higher than the edge of the walk, that effectually dams the water and prevents its flow to the gutter.

In dealing with transverse slopes we find that the maximum incline in a walk on level grade is the transverse slope perpendicular to the direction of the walk, and that as the grade increases, the maximum incline shifts with the width and slope of the walk, so that on excessive grades we find the surface water flowing nearly parallel with the center of the walk.

The direction of this maximum incline may be defined as the hypothenuse of a triangle of which the width of the walk is the altitude and the base is the width of the walk multiplied by the ratio of the percentages of the walk gradient and the transverse slope. For example, given a walk 6 feet wide on a 10 per cent. grade, with a transverse slope of ¼ inch per foot, we find that the ratio of percentages of gradient and slope, multiplied by the width of the walk, equals 28.8 feet, and that the surface water will flow diagonally from one corner to the other of a stretch of walk 28.8 feet long. Pursuing this a little farther, we find that this diagonal is on an incline of 10.21 per cent., as against the prescribed 10 per cent. longitudinal gradient. The combined effect of transverse slope and longitudinal gradient is to increase the prescribed incline of the walk, and to lead the surface water on and along the walk instead of across it, both of which results add to the hazard and discomfort of the public using the walk.

It would therefore seem reasonable to require that surface drainage should be confined to the shortest path across the walk, wherever possible, and that a limiting angle should be fixed, beyond which it should not be permitted to go. Assuming that the path of drainage be confined between the limits of 90 degrees and 45 degrees with the direction of the walk, substituting the value of any required transverse slope, making the base equal to the altitude, and solving for per cent. of grade in the formula given, we find that in each case the limiting grade is equal to the transverse slope. This relationship may be best shown by the following table:

Transverse Slope, Inches per Foot	Per Cent. of Transverse Slope; Also Limiting Grade	Inclination of 45 Degree Diagonal Per Cent.
1/8	1.042	1.47
1/6	1.389	1.96
1/5	1.667	2.36
1/4	2.083	2.94
1/3	2.778	3.93

It will be observed that the inclination of the 45 degrees diagonal is in all cases approximately 40 per cent. greater than the corresponding transverse slope.

This table gives us working limits for any assumed slope. Thus, assuming that ¼ inch per foot is the minimum permissible slope for satisfactory drainage, and ½ inch per foot is the maximum permissible slope, we find that ¼ inch per foot may be used on grades from 0.00 up to 2.08 per cent.; that 1/5 inch per foot may be used on grades from 1.48 per cent. (interpolated) to 1.67 per cent.; that 1/3 inch per foot may be used on all grades less than 2.78 per cent.; that ½ inch per foot may be used on level grade only, and so on for any of the other slopes, if the cross-drainage is to be confined to the shortest reasonable paths across the walk.

If the surface drainage could be confined to the amount of water falling on the area of the walk alone, if it was uniformly distributed, or if the walk is of short length, the issues here raised would be without point, but this is rarely the case. Property owners will spend considerable sums of money in leveling their premises so as to drain away from the dwellings and toward the street. Private walks and driveways are often water collectors, discharging upon the public walks, with no regularity of interval and in such manner as to often make the walks unduly hazardous during the cold and wet season. This drainage also has a tendency to wear fixed water courses along and in the walk. For these reasons all effort should be made to rid the walks of water as quickly as possible, and the method here offered will apply to grades up to 4 per cent.

Again, the principles enunciated are sufficiently obvious to most of us to be axiomatic, but it is not unusual, in formal sidewalk specifications, to find requirements for transverse slope, without regard to grade. The average contractor engaged in this class of work will blindly follow a "rule of thumb," with acquiescence on the part of the average inspector allotted to the engineer, unless explicit instructions to the contrary are issued.

How should walks laid on grades in excess of 4 per cent. be treated?

At first glance it might appear desirable to give the walk a crown similar to that prescribed for pavements, in order that the middle of the walk, which is also the path of the greatest number of pedestrians, may rapidly shed snow, ice and water. It might also appear less objectionable to have a gradually increasing and curved incline on either side of the center, than to have all of the incline in one direction across the walk. As the principles already stated for transverse slope apply with the same force to a crowned surface, and for the further reason that this form of construction would have to be built with greater care than is usually accorded this class of work, and at a greater expense, this idea may be dismissed without further comment.

The answer to this question appears to lie in restricting the amount of surface drainage to the area of the walk by either providing suitable depressions in the earth surface on either side of the walk, or laying artificial drains to serve the same purpose. The walk should then be laid without transverse slope, as the longitudinal incline is sufficient for purposes of drainage.

In connection with the subject of slope in the parking, brief mention may be made of the admissibility of steps in sidewalk construction. As a general proposition the writer is of the opinion that they should be avoided wherever it is possible to do so. They are from 400 to 500 per cent. more costly than walks of the same area, exclusive of proper guard rails; they add to the expense of maintaining the parking by creating excessive slopes; they subject the public to needless hazard in sleeting weather; they are dangerous to persons afflicted with bodily infirmities; they add to the lighting bill of the city. The objections apply to all ordinary conditions. Situations undoubtedly exist where steps afford the only possible convenient means of ingress or egress for the public from one street to another, or from one section of a city to another. On residential streets of short extent, where the lot lines may lie parallel with terraces, and where the street walk may be placed at a considerable distance from the curb, steps may be used with good effect. Cement walks with a float finish, brick walks laid of unglazed brick, and cinder walks, on grades as high as 12 per cent., and possibly higher, may be used by the public with no apparent discomfort at all times, except when the walks are covered with ice, and the insertion of steps for the purpose of reducing the grades would appear to be of doubtful economy. Limestone flags and walks constructed of glazed tile, in vogue in some sections of this country, are slippery in wet weather on relatively low grades. There is one feature of the prescribed slope for park-

ing that deserves consideration in communities of rapid growth, where certain streets in the residential districts are so located as to invite invasion by business houses. In such localities the slope in the parking should be held down to the minimum commensurate with satisfactory drainage, in order that the walk may be extended out to the curb without creating an excessive inclination or needlessly require building up over the top of the curb.

Given two walks, A and B, located parallel with corresponding curbs, a and b.

Let Aa equal distance between curb and walk A.

Let Bb equal distance between curb and walk B.

Let Wa equal width of walk A.

Let Wb equal width of walk B.

Let Sa equal per cent. of slope in parking for A.

Let Sb equal per cent. of slope in parking for B.

Let IA equal transverse incline in A in percentage.

Let IB equal transverse incline in B in percentage.

Let %a equal per cent. of grade of curb a.

Let %b equal per cent. of grade of curb b.

Let ab equal elevation of grade at intersection of curbs.

Let AB equal elevation of grade at intersection of walks.

Then, for walks of equal width and equidistant from the curbs, when the curbs leave the intersection on equal ascending grades, and with uniform slope in the walks and uniform slope in the parking, for both cases, AB equals ab plus (Bb plus Wb) %a plus (Aa) Sa plus (Wa) IA.

The symbols here used are applicable to requirements for walk A.

While this formula, and others that will be referred to, may seem long and involved, a mere glance will show that they require but the simplest of arithmetical operations in their solution and that the symbols are used simply for brevity.

For walks on level grades the second term, (Bb plus Wb) %a, is equal to zero, and therefore drops out. For curbs on equal descending grades the second term, (Bb plus Wb) %a, is prefixed by a minus sign. In other respects the formula is the same and may be used for the three conditions.

If one walk is wider than the other, and (Bb plus Wb) is equal to (Aa plus Wa), satisfactory results may be had by taking the mean of AB, as obtained by the formula as written and when B and b is substituted for A and a. It must be borne in mind, however, that where the curb grades exceed 4 per cent. the slope in the parking should be reduced on ascending grades in order to avoid excessive inclination at the approach to the curb.

If the walks are of the same width, but walk A is remote from the curb and walk B is near the curb, where the curb is on level grade, then AB is obtained by inserting in the formula the nomenclature applicable to the walk B (nearest to a curb). In case this determination leaves little or no slope in the parking along walk A, the grade equal to

$$\frac{\text{(Bb) Sb plus (Wb) IB}}{\text{Bb plus Wb}}$$

should be extended through point AB, to an intersection with the regular gradient of walk A. Solving the formula for AB for both walks and subtracting the result obtained for the near walk from that obtained for the remote walk, we find a certain difference in elevation, which, divided by

$$\frac{\text{(Bb) Sb plus (Wb) IB}}{\text{Bb plus Wb,}}$$

gives the distance from the point AB to the grade intersection. We thus find that walk B has one controlling grade point located at the walk intersection, while walk A has two, one of which is located at the intersection of A and B and the other at some distance therefrom, at the intersection of the two gradients. If the curbs in this case depart from the intersection on substantially equal ascending grades, the formula should be applied for walk B, the same as for level curbs, and the AB so found should be used for controlling grade for both walks A and B. If the curbs in this case depart from the intersection on substantially equal descending grades, the formula may be applied in the same manner as for ascending grades, except where this result causes a reverse slope in the parking along the remote walk, when two controlling grade points in the remote walk A should be determined as described in a previous case.

It is not the intention of the writer to go into wearisome detail of this whole subject. The variations in the relationship between sidewalk and curb are almost infinite, but the general principles to be borne in mind in the solution of any given problem are not many, and can be applied to almost all combinations. His purpose

is to lay stress upon matters often disregarded because of their seeming insignificance, and to aid in securing proper recognition and rational treatment of the sidewalk question.

The sidewalk is in reality the most important surface structure on a street, for the vast majority of the public travel on foot. Many a family has lived through generations without owning a vehicle of any kind. The householder may carry his drink, food, raiment, and even his furniture, fuel and building materials without the use of a road, but he cannot be deprived of a foot path leading to his home or to his means of livelihood.

Serving so many of us, it does not seem unreasonable to ask that the sidewalk be given a place of equality with and that it receive the same application of professional skill in design that is accorded to that part of the street devoted to the use of brutes and vehicles.

One does not have to travel far and wide, nor to observe sidewalks in many cities, to find horrible examples in sidewalk grades and be impressed with the inequality that exists in this matter, and which is generally occasioned by indifference and neglect of some one.

The location of walks with reference to curb lines and property lines is often considered an executive duty, in which case the engineer may not be consulted, and the location is fixed by some arbitrary rule. By applying the methods previously discussed for the determination of sidewalk grades at street intersections it will be readily seen that the location of the walks with reference to the curb lines may be rationally determined by the gradients of the intersecting and adjacent curbs.

Reversing the operation heretofore described, the required elevation of grade for curb intersections may be determined from given conditions for sidewalks. We thus come to the question of establishing curb grades, and it may be pertinent to inquire if it is sufficient to prescribe elevation of grade for curb intersection only, and use uniform grade for curb throughout a block in all cases, or, if it would not be well under certain aggravated conditions to break grade at intersection of walks with curbs, in order to modify steep walk approaches.

It is quite customary in small towns and in certain rapidly growing sections of the larger cities, where there is not immediate call for paved or curbed streets, to establish walk grades without regard to how a future curb grade may fit. Again, such places may have established grades for curbs, with no regard as to the possibility of placing a future walk at a desirable grade. Either of these conditions, upon the ultimate completion of the street improvements, gives rise to situations that have all the earmarks of unsightly, inconvenient and objectionable patchwork, against which the public may with justice protest.

Bituminous Pavements, Patented and Otherwise*

By E. A. Kingsley, Superintendent of Public Works, Little Rock, Ark.

IT is not necessary in a discussion of this subject to go into the study of asphalts and coal tars. It is my desire only that your attention be called to the fact that modern bituminous cements, under various names, are but new names for a very old thing. So far as the writer has been able to learn, however, bituminous cement or bitumen for paving purposes is of latter day origin; and, while the ancients knew of the cementing qualities of bitumen properly used, the thought of using it for the purposes of street paving never occurred to them, and it was left to man in the nineteenth century to find what a valuable asset this material is when properly used for paving purposes.

Probably the first bituminous pavements in the United States were laid in Brooklyn late in the sixties, the outgrowth of sidewalks built under the old Scrimshaw patents. . The foundations consisted of broken stone mixed with stand, cinders and tar; the wearing surface was the same mixture, but the stones used were not to be larger than one inch. These pavements were remarkably good and lasted many years. So long as a good quality of coal tar could be obtained

*A paper before the American Society of Municipal Improvement.

good pavements could be laid, but when good cemented material was not used poor results were obtained.

[The writer here skteches the history of asphalt pavements from Edward Joseph DeSmedt's patent of May, 1870, through W. H. Foye's of November, 1870; those of Frederick E. Mathews, of Chicago; A. B. Vandemark, of Jersey City, and James M. Hawes, of Covington, Ky., issued in 1871, using crushed stone or shells, and Aaron Van Camp in 1876, who was awarded a patent, the particular point of which seems to be that crushed stone, graded as to size, will make a more compact mass and a better pavement than smooth surfaces not graded as to sizes. In other words, the voids may be lessened by Van Camp's method.]

The early coal tar and asphalt pavements were all what we now know as bituminous macadam or bituminous concrete pavements, and it was not until Mr. DeSmedt had laid his experimental pavements in 1869-70 that a wearing surface of pulverized rock and bitumen or sand and bitumen was used, and it is from these DeSmedt experiments and pavements, which were an attempt to imitate the European lime rock asphalt, that our modern sheet asphalt pavements have grown.

So many failures of coal tar pavements had been made that the successes were overlooked, and the DeSmedt successful experiments led to the adoption of his pavements by the authorities at Washington, and from Washington the asphalt pavement industry, as it has been known, spread all over the country. The older methods, excepting in isolated districts, were forgotten and the successful Vulcanite pavements were not duplicated. There were a few splendid pavements laid, however, in different parts of the country which kept alive the old and tried methods; around the old cathedral at Eighth and Plum streets, Cincinnati, O., is a bituminous concrete pavement which has been in constant use for nearly fifty years. This pavement is composed of a mineral aggregate of crushed stone, graded from one inch down to an impalpable powder, gravel, sand and coal tar. It is in good condition today.

The old Vulcanite pavements were made of the same material as the Cincinnati cathedral pavements, but the cementing agent was sometimes asphalt and sometimes coal tar. In a number of cities these Vulcanite pavements gave excellent service and in many places they are still in use.

In 1891 and 1892 a number of alleys in the downtown district of Denver, Colo., were paved with asphaltic concrete. The writer having lived in Denver several years is more or less familiar with these pavements. They consist of a mixture of crushed stone or gravel, sand and an asphaltic cement, mixed in proportions that produce a solid mass, and while in some instances a light wearing surface was made of screenings and sand with asphaltic cement, in every instance the mixture was made in a mixing machine and placed in the street as are what we know as our asphalt pavements of today. These pavements were all made and laid under the supervison of Marcus M. Hodgman, superintendent for the Blake Asphalt Company, at that time of Denver, Colo. Mr. Hodgman had for years experimented with asphaltic mixtures and the proportions of sized rock and cement were carefully looked after.

The city of Pittsburg, Pa., has undoubtedly more old asphaltic concrete pavements than any other city; thousand of yards of which have been in use since the early nineties. Much of this old pavement is in constant use and in almost perfect condition today —while adjacent to a great deal of it can be found the modern "sheet" asphalt pavements, which have been laid at later dates and many of which have worn full of holes.

Of the latter day bituminous pavements there are so many, patented or otherwise, that one needs a pocket index to keep track of them.

With modern crushing plants and modern machinery it is possible to produce a better mixture today with fewer voids than it was twenty or thirty years ago, and pavements of like character today should, in the same degree, be uniformly more perfect. But while the modern methods and modern machinery should have lessened the costs of these pavements, owing to the fact that F. J. Warren succeeded in 1901-2-3 in patenting this old method of paving, the costs have been increased rather than decreased, and, on account of threatened litigation, cities and contractors have been kept from laying these pavements. In other words, the various bitulithic companies, having an ideal pavement, have been free to charge all that the community could stand, regardless of the worth of the pavement, or the cost

of its construction because of the patents.

[The writer here quotes from the specifications of Mr. Warren's patents.]

The writer has no fight to make on bitulithic pavements; on the other hand, we believe that properly built bituminous concrete or bitulithic pavements are absolutely the thing. The theory to the writer's mind is correct, but the patent is wrong and has worked and may work hardships on contractors and communities.

Now a little more history.

From 1891 to 1898 Mr. Frederick J. Warren was manager of the Colorado Paving Company, at Denver, and the representative of the Barber syndicate. During 1891-92 while Mr. Hodgman was laying asphaltic concrete for the Blake Company in Denver, Mr. Warren was fighting the proposition as a failure and bringing all of his backing to bear upon Mr. Hodgman and the Blake Company.

In 1892 Mr. Warren was called upon by the city to tear up a portion of the Denver tramway tracks in Curtis street, between Seventeenth and Nineteenth, and he personally took charge of the work. However, he found the asphaltic concrete so tough and the job so difficult that he gave it up after four hours' trial with but little accomplished and the company went ahead with its work, leaving the tramway tracks with the asphaltic concrete pavement between them. This pavement remained intact alongside the Curtis street asphalt until 1898, when it was removed with the tracks on account of an entire reconstruction of the tramway company's lines.

But what of Mr. Warren? He evidently had changed his mind, for in 1901 he applied for a patent on the pavement he had denounced so thoroughly ten years before, and, in the light of the nine years since 1901 he did wisely. The writer does not believe that he was entitled to the patent; Marcus M. Hodgman had showed Mr. Warren what could be done but Mr. Hodgman did not want a patent. However, Mr. Hodgman died in 1897. Mr. Warren left Colorado in about a year after and in 1901 he received his patent.

[The writer here epitomizes the Owosso case heretofore reported at some length in MUNICIPAL ENGINEERING.]

I have followed the several suits that have been brought by Warren Brothers Company to restrain cities and contractors from laying bituminous concrete pavements, and it is my understanding that in no case has there been introduced any evidence to show the use of bituminous concrete mixtures for paving roadways prior to the Warren patents. In each case when this evidence has been at hand there has been an agreed decree entered as in the Huntsville and Birmingham suits, and those at Topeka, Kan., and Creston, Ia. In the Topeka case affidavits were filed claiming that if the defendant was allowed to proceed and lay the bituminous concrete pavement as contemplated the plaintiff would receive irreparable damage, such a pavement mixture would infringe upon their said patents, etc., but when the defendants were able to force an issue and get the case set for a hearing on its merits, over the protest of the plaintiff, the bitulithic attorneys made haste to bring about an agreed decree, allowing the defendant to proceed with his work. The only stipulation against the defendant was that he should lay a mixture which was described by Mr. Kirschbraun, of Chicago, as being the results of his examination of Denver and other pavements examined by him as expert for the court. As the defendant had bid upon the same specification, this decree, signed by Judge McPherson, by the attorneys for the defendants, by the city attorney and by Mr. J. M. Head, of the Warren Brothers Company, amounted to an acknowledgment that there was nothing but bluff in the Warren contention and that this time their bluff had failed to work.

By reason of the unjust patents the people are compelled to pay from $2.00 per square yard up to prices too ridiculously high to mention, for tar macadam mixed and laid as bitulithic, whereas $1.25 per square yard would, in most cases, be a good price. The truth of this is proven by the city of Nashville, Tenn., which lays its own bitulithic pavements under a contract with Warren Brothers Company, of Boston, they paying a royalty of twenty-five cents per square yard; including this royalty the city of Nashville is able to construct its bitulithic pavements at a total cost of about $1.25 per square yard, as I am informed and believe.

As I stated before I have no fight to make aaginst bitulithic pavements; they are good pavements when well built and will stand the test of time, but my city did object to being held up by what we conceived to be an un-

just monopoly working under patents which we did not believe would hold water. So, I set about long ago to try to find if there were not some way out. I knew of the Denver pavements and of the Washington tar macadam, and my investigation led me to the pavements laid by Booth and Flynn in Pittsburg and to others.

In consequence of this investigation we have adopted specifications which will admit bitulithic, which are in keeping with Mr. Kirschbraun's analyses of the Denver and Pittsburg asphaltic concrete pavements, and the decrees in the Creston and Topeka suits, along with and on an even footing with bitulithic and other similar pavements.

There can be no question of the comparative merit of the pavements under consideration; certainly the demonstrations made at Denver and Pittsburg prove the merit of those paving mixtures; they are eight and ten years older even than the oldest bitulithic pavement in existence.

I want it to be understood that I am favorable to the paving mixture known as asphaltic concrete or bitulithic; that is to say, a mixture of crushed stone, sand and asphalt or coal tar, heated and mixed together in proportions that produce a solid or concrete mass, and from my observation I believe the mineral aggregate composed of stone that will pass a ½-inch mesh is better than where larger stone is used. In all cases where I have examined the old pavements composed of larger stone I find that the large stones fracture under traffic and start the pavement to ravel or wear away.

My desire in this matter is to point out the way by which we can get the benefit of the best demonstrations that have been made in bituminous concrete without paying a royalty to any concern.

Reply by George C. Warren

I VERY much regret that I did not have a copy of Mr. Kingsley's paper in order that I might more intelligently and accurately discuss the contents.

In the first place the paper refers to asphaltic concrete pavements, the wearing surfaces of which are not asphaltic concrete at all, a fact which proves the looseness of the application of terms in speaking of pavements. "Asphaltic concrete" is used to mean almost anything. The term "asphaltic binder" is used to mean either pure bitumen which is poured onto the stone, mixed with the stone in pavement construction, or the bitumen-coated stone used as an intermediate course between the foundation and wearing surface of the standard asphalt pavement, totally different applications of the same term.

The burden of the paper I may fairly say refers to Pittsburg and Denver.

First as to Pittsburg, I happen to have here photographic copies of the contract referred to in the city of Pittsburg. This particular one is Fifth avenue, one of the pavements referred to by Mr. Kingsley. That pavement is not called "asphaltic concrete." It is not asphaltic concrete, but it called an "asphalt pavement." The cement used was called vulcanite, being a mixture of Trinidad asphalt and coal-tar pitch. Before this time and right up to the time of development of bitulithic pavement, there was universally used what is now called the "open binder," that is, a uniform sized stone, generally specified as all passing one inch, sometimes one and a half inch screen, using nothing which will pass a quarter or one-half inch screen.

The object of that open binder was to overcome the slipping of the asphalt on the foundation. It was essential from that point of view the the bituminous binder be open and as rough as possible. To produce the stone it was necessary to screen out the fine particles below a quarter of an inch. It was a very common thing to turn the small screenings into the sand mixture, as it would otherwise be waste.

Messrs. Booth & Flynn laid the pavements under these specifications, which call for a pavement laid in three courses: First, crushed stone poured with "vulcanized cement," as it is termed; second, an open binder course, all particles of which these specifications say shall be coarser than one-quarter inch. The asphalt wearing surface was made of sand with a small proportion of crushed screenings, which the specifications state not to be coarser than one-fourth inch. That, I say, is not in any sense "asphaltic concrete." I am very sorry I did not know that this question was coming up, as I could have had some samples from a portion of that street where

the original construction is still in existence, showing the surface, which is simply a sand mixture with a little one-quarter inch stone and a sawed section of which looks like a very lean fruit cake, with occasional currants one-half inch or more apart. (A sample of the pavement was shown later appearing as described.) That is not concrete. There are portions of this pavement which are today in existence in which the asphaltic sand surface, or more properly termed asphaltic mortar surface, was laid very soft, in fact so soft as to have been almost impassable when laid, and portions of the surface have been pressed into the binder to a certain depth; and where the asphaltic surface is entirely gone today you have an appearance of the thirds of the surface patched with asphalt pavement. If the old surface was satisfactory, why patch with asphalt and sand, without any stone?

Here is another photograph looking down on the surface of one of these pavements, on a portion where the asphaltic mortar surface is not entirely worn off. On the surface is a 10-cent piece, which will show relatively the size of the few particles of fine stone in the surface. So much, gentlemen, for the so-called Pittsburg asphaltic concrete pavement. I have no quarrel with the Pittsburg pavements, if they are classed where they belong.

The next point is that referring to Denver. When the pavement was first presented to this body and every other

FIFTH AVENUE, PITTSBURG, PA.

asphaltic concrete pavement. It was not asphaltic concrete pavement when it was laid, and I am sure no one would accept such a pavement to-day. Perhaps the strongest evidence which could be given of the fact that these pavements were not satisfactory is that they have not laid a yard in the last fifteen years. Perhaps the strongest testimony we could present here without having affidavits or sworn testimony, is the fact that the city of Pittsburg does not recognize these pavements as an anticipation of the Warren patents, and that they have executed a license with the Warren Brothers, under which the city of Pittsburg will in the future lay bitulithic pavements with its municipal plants.

Here is a photograph of one of the streets, which shows an absolute absence of traffic, and yet it shows two-

engineering society in this country, no hint was made that it was not a novel pavement. There has not been a square yard of pavement in the city of Denver, laid during the period which Mr. Kingsley referred to, in which the wearing surface was made from crushed stone or gravel. Mr. Blake laid some alleys in the city of Denver with a mixture of asphalt and gravel just as it came from the gravel bank, as a foundation, and on top of that surface a standard asphaltic sand mixture two inches in thickness. That is the Denver pavement, and if I had known this matter was coming up, I would have had samples and affidavits to prove it.

In regard to the Topeka litigation, the Denver pavements were no anticipation, were absolutely different pavements, and the contractor, having made a contract to lay a pavement in

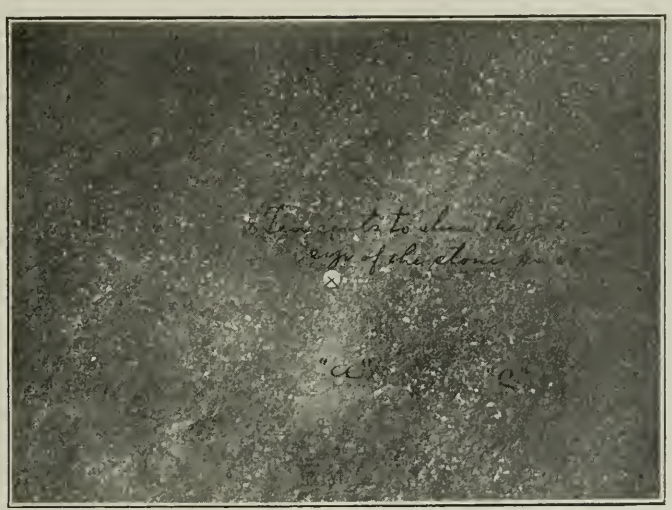
Topeka which would be a clear infringement, comes before the court and says, "I have permission from the city to change the specifications, so as to lay a different pavement, one which contains only 10 per cent. of stone coarser than one-fourth inch, and all of which will pass a one-half-inch screen." This amended form of pavement is not an infringement, neither is it asphaltic concrete, and is approximately a duplication of the Pittsburg pavement referred to. If such a pavement is satisfactory to municipalities, I have no objection to its use, but such a pavement should be termed as it is, an asphalt pavement or asphaltic mortar pavement, not asphaltic concrete.

Mr. Kingsley refers to a similar case at Creston, and the pavement as laid was an asphaltic pavement, specifications stating that not to exceed 10 per cent. of it was to remain on a quarter-inch screen and not exceeding 20 per cent. of it was to remain on a No. 10 screen. The surface, therefore, is not exceeding 20 per cent. coarser than 10-mesh sand.

Concrete, whether with asphaltic or hydraulic cement, means a material of coarse and fine aggregates, the coarse particles of which predominate. If the fine particles predominate, you have the conditions similar to the occasional currant in a loaf of cake.

Mr. Kingsley referred to the five years' litigation we had with the city of Owosso, defended by the largest asphalt company in the world. They showed a sidewalk at Long Island City and a concrete reservoir lining. They knew about the Denver, the Washington and the Pittsburg pavements; no one knew them better. Consequently evidence of these pavements was not presented to the court.

Referring to the city of Washington, it has been stated that pavements have been laid which anticipate the Warren patents, but again there is a confusion. The early specifications in the city of Washington, as also clearly shown by the small bits of original surface still remaining, like the early pavements of the city of Pittsburg,



SURFACE OF ASPHALT STREET, PITTSBURG, PA.

distinctly described pavements laid in three or more layers, the bottom layer being of stone about three to four inches in size and intermediate binder course of one inch size, with wearing surface about two inches in depth, of mixtures of sand and coal-tar bitumen. To-day there are patches in the center of the street (most of the pavement having long since been resurfaced) where the wearing surface, which was originally laid very soft, has been worn away, but portions of it pressed into the binder course, the now exposed surface having an appearance of bituminous concrete, which it was not when laid, as is clearly proven, not only by the specifications of the contract and other evidence, but by the present condition of the surface next to the curbstones and other places which have not been exposed to traffic, where the original bituminous sand mixture surface is still found.

Pavements of Erie, Pa.*

By Faulkner G. Lynch, Deputy Engineer in Charge of Paving Construction

IN considering the pavements of the city of Erie, we find a number of different kinds, although not of such a great variety as have been used in some other cities of this country.

Pavements have been laid of wood blocks, stone blocks, cobblestone, macadam, block and sheet asphalt. Much has been learned by experience with these different varieties of pavements, and at the present time, having profited by the experience of the past, the experience of other cities, and the advice of some of the best authorities, a standard of construction and specifications have been produced for the building of the more modern of these pavements, which we believe have produced excellent results, and after some years of wear, show for themselves a great superiority over work of the past.

As we know, the method of procedure preliminary to the laying of a street pavement differs in different states. In some places commissions are appointed which control the letting of contracts, select the material, appoint engineers and inspectors, and take entire control of the work. This is not the case in this city, which is under the laws of Pennsylvania governing third-class cities.

When the time has arrived at which it is thought to be a necessity to pave a certain street, an ordinance is passed in the councils providing for the grading, curbing and paving of that street, stating that the city engineer shall advertise in at least two newspapers published in the city of Erie, for one week, for proposals for the construction of the improvement, and shall draw up and exhibit in his office full specifications and plans for the construction of the work, and shall furnish each bidder with blank proposals, and such other information as may be necessary to enable him to submit a bid correct in form. The ordinance also contains provisions for the collection of the cost of the improvement, which is usually assessed by the foot frontage rule for the curbing, paving and draining. At the present time paving ordinances provide that the assessments shall be payable in ten equal semi-annual installments, with interest, the first due in thirty days after the completion of the work, and the balance in nine semi-annual installments, with interest at 6 per cent., or it is optional with the property owner to pay the entire assessment at once. It is the duty of the city treasurer under the terms and conditions of the ordinance to collect all installments when due. If it is impossible for him to collect the installments, he is to deliver to the city solicitor a certified copy of all unpaid assessments, at the expiration of four months, for the purpose of filing liens. For the purpose of paying the contractor the ordinance provides that the mayor shall issue street improvement bonds, to be denominated "Erie City Street Improvement Bonds," under the seal of the city and in the sum of $500 or fractions thereof, bearing interest at 6 per cent. and payable by the city treasurer. The contractor may take either the bonds or cash, or may, at his option, take an assignment of the assessments against the property, but the contractor must designate in the contract to be signed by him whether he elects to take bonds or assignment of the assessments in payment of the cost of the work. The ordinance also makes an appropriation to cover the entire cost of the work, stating the portion assessable to private property and that assessable to the city, which consists of the intersections and alleys, church, school and city lots fronting upon the improvement.

It may be of interest to know in what manner assessments against the different properties are computed. There are two methods of assessment authorized by the state law, one being the assessment by the foot frontage rule, and the other by viewers, both being in use in this city. An assessment by the foot frontage rule covers the entire cost of the work, including inspection and cost of analysis and testing of materials as carried on from day to day by the department of engineering, this total cost, after deducting the cost by the yard for alleys and street intersections, being divided by the total feet front of property abutting upon both sides of the improvement. The assessment by viewers is somewhat similar, the cost per foot front being figured in the same manner by the department of engineering, but submitted to a board of viewers appointed by the judge of the county courts. It is the duty of the board of viewers to adjust and fix the benefits or damages against the different

*A paper before the American Society of Municipal Improvement.

properties in a just and equitable manner, an illustration of this adjustment being the assessment against a triangular shaped lot. By the strict frontage rule, assessment would be made upon the entire side extending to the outermost point of the triangle abutting upon the street, whereas in an assessment by viewers perhaps a fair proportion of the valueless point of the triangle would not be considered as assessable, and the city would be required to pay for that portion. There are other features of this method of assessment which make it valuable in the paving of streets of irregular width and shape, particularly if some portions be occupied by street car tracks or railroads. The total costs of all improvements are compiled in an itemized and tabulated form in the department of engineering, and certified to by the city engineer before an assessment is made.

In considering the condition of the different kinds of pavements on the streets of this city, we find them in fairly good condition, owing to an effective system of making repairs by the department of engineering with funds appropriated for that purpose. While the city has not yet succeeded in obtaining a municipal asphalt plant, the time is not far distant when it will make its own repairs to asphalt, as it is now doing to other pavements, and undoubtedly at a great reduction in cost, the necessary land for the location for such a plant having already been acquired. The saving of expense for repairs to asphalt pavements will grow greater as time goes on and the guarantee periods expire on the various pavements, which must then be maintained at the expense of the city.

In this city a thorough system of inspection, both of material and actual construction of the work is now in force and has been so for the past three years. Examinations are held from time to time of applicants for the positions of both sewer and paving inspectors. This examination consists of questions bearing directly upon the methods of construction and quality of materials to be used in the work. After this examination by a board appointed by councils, consisting of the city engineer and plumbing inspector, and from those men who show a clear understanding of the work the mayor appoints six ward inspectors, and the city engineer appoints as many paving inspectors as are required. All give bonds in the sum of $2,000. The time has arrived in this city when a mere ward politician, who has, or thinks he has, political influence, cannot superintend public work unless he is thoroughly capable, and it is an undisputed fact that much poor work done in the past can be directly traced to the fact that inspectors with no knowledge of the work have attempted to superintend the construction of pavements and sewers in this city.

After the line and grade stakes on a pavement have been set by the engineer in charge of paving construction, the chief inspector, a man experienced in every branch of asphalt paving work, who is also appointed by the city engineer at an annual salary, inspects the progress of the work, the mixing of asphalts at the various plants, and superintends the inspectors on the different jobs. He secures samples of the mixtures daily for analysis at the office, where the engineer in charge of paving construction tests all the different materials used in the work, asphalt mixtures, oils, cements, brick, sand, and gravel, and keeps a complete record of all such tests.

The city is now in possession of a sufficiently complete testing laboratory for such purposes, resulting in a great saving in expense for the testing of materials, as the actual cost of making the tests in the city laboratory is very small. We have in the exhibit room in this building samples of asphalt surface laid on streets of this city at a time prior to the establishment of a satisfactory system of tests and inspection, also samples cut from streets laid under proper inspection, where the materials have been analyzed and tested from day to day during the progress of the work. I may say that the comparison is quite interesting. Not only has great improvement been made in the quality of materials, but also in the construction of street pavements, some features worth mentioning being the rolling of the sub-grade with the city's ten-ton roller, for which the contractor pays the city one cent per square yard of surface rolled. Concrete of the prescribed thickness is now required not to exceed a given area of surface per barrel of cement used, also cement curb must not overrun a given measurement per barrel of cement used. Steel T-bars, bent to 5 or 8-foot radius, as the case may require, are used to reinforce the curved pieces of curb in street intersections. Brick gutters are now used on all asphalt streets and are usually laid 3 feet in width. Particular attention is paid to crown of surface of pavements, which varies in proportion to the grades adopted. Some newly paved streets, 100 feet in width, have been paved with double

driveways, each 20 feet wide, with 16-foot parkways extending through the center. These, when planted with shade trees and seeded in grassy lawns, improve and beautify the street and increase the value of real estate along these boulevards. Asphalt pavements which require a certain thickness of surface and binder under their respective contracts may be relied upon to be of the correct thickness when laid under this system of inspection. Erie being situated upon the shores of Lake Erie, is in a favorable location for securing the best of lake sands, which enter into the composition of our asphalt pavements, and require but very little grading to produce first-class mixtures. The percentage of bitumen required to produce the best mixtures with these sands may be slightly less than that required by some bank sands, and it has been determined by analysis that from 10.5 to 10.9 per cent. pure bitumen, with filler of limestone dust of 7 per cent. in Trinidad asphalt top mixtures, with penetration of 60 for the asphaltic cement, produces good results; for Bermudez and California asphalt top mixtures, with penetration of 55, 10.5 per cent. of filler is required. These proportions produce mixtures which are neither too hard nor too soft, and a wearing surface which has given complete satisfaction.

It is a well-known fact that competition reduces prices, and this is found to be the case in the building of street pavements in Erie. In the early days of asphalt paving, about 1890, Erie paid from $2.65 to $2.90 per yard for complete pavement of surface, binder, and 6-inch concrete base, with natural cement and bank gravel. These prices have been steadily reduced until the bottom was reached some five years ago, at $1.24 per yard. At the present time the city is paying an average of $1.50 per square yard for asphalt, exclusive of curb, on a 5-inch base of Portland cement, lake sand and washed gravel concrete, and about the same price for brick pavements. In consideration of the fact that assessments are payable in ten semi-annual installments, it has been found that the sentiment against the laying of pavements has almost entirely disappeared in this city, which can boast of more and better pavements than most cities of its size.

Des Moines Public Buildings

THE city of Des Moines has now been more than two years under the so-called commission form of government, and the second report of the city auditor, made under the direction of the superintendent of the department of accounts and finance, has recently been issued. It is mainly devoted to statistical tables, mostly financial, but is preceded by a brief historical sketch of the principal recorded events in the growth of the city, and by the full statute under which the present administration is acting.

The accompanying photographs, for which we are indebted to J. W. Hawke, city auditor, and Chas. W. Schramm, the superintendent of the department of accounts and finance, show some of the public buildings in the city. The first shows the laying of the cornerstone of the new municipal building, on June 14, 1910. This is the first building erected for the municipal business of a city governed by a commission, and is located on the river front, in conformity with a well-considered plan for a civic center, boulevards and parks for the enhancement of the beauty of the city. When completed its appearance will be as shown in the second photograph. The third photograph shows the large room in the middle of the second floor, which will be used for a counting room for all the departments of the city government. The success of this plan can only be shown by actual test, and the results will be awaited with interest.

The fourth photograph shows the eastern entrance of the Polk County Court House, one of the other prominent buildings in the civic center plan. Its location with respect to the new municipal building can be seen in the second photograph, the tower of the court house showing at the extreme right.

Des Moines is one of the cities having a system of ornamental lighting, and the fifth photograph shows Walnut street at night, illuminated by tungsten electroliers. It must now contest the title of the "best lighted street in the United States," once given it by the *Electrical World*, with several streets and groups of streets in other cities which have recently installed more or less extended systems of ornamental lighting in their principal business streets.

I. LAYING CORNER STONE OF NEW MUNICIPAL BUILDING, DES MOINES, IOWA.

Supervision of Municipal Work*

By Will P. Blair, Indianapolis, Ind.

THERE are many questions with which we come in close contact, or with which we actually must deal, that are mooted or about which we disagree with reason or plausible excuse, but under a wide range of experience and observation there comes to us much that is so utterly inconsistent with human reason or intelligent purpose, that, from our viewpoint, at least, it is utterly inexcusable. Common with all, municipal matters come within these limits. Try as we will, to those of us whose business brings us into contact with, or to those who are making special study of various municipal problems, it would seem that they bear a burden of undue proportion of evils unreconciled within the bounds of reason. So many things are so inexplicably inexcusable that we sometimes want to characterize them softly because we are ashamed to speak the naked truth. But how can we hope to correct abuses unless we hold them up to view with all the daylight of truth, with severest search and utmost scrutiny? The very name of this society suggests that its purpose is to strive for progress and advancement in municipal concerns. Fault and dereliction should be replaced with corrected measures and integrity of purpose.

How shall we make competent and honest but by pointing out the awful examples—the inefficient and the unreliable? The public welfare does not suffer altogether from a single agency or from several agencies. The public is frequently neglectful in some—perhaps many—ways of her own interests. Stupidity and carelessness on the part of the public is no less to be condemned than when found in the individual. But, the sentiment that the public deserves all she gets, and possibly more, simply because we naturally expect that some one is on hand at all times in this country, stirring the public to alertness and watchfulness—oftentimes in the directions even from which comes no alarm—is the excuse of the petty grafter and is unworthy of a trusted public official or employe. If there is to be a distinction in the honesty of dealings, let them be more honest when dealing with the public. The public is practically helpless in our hands, and for this reason alone should command our most honorable service.

Very recently, in a city of less than 75,000 inhabitants, a street was to be improved, in fact was being improved, of which the wearing surface was vitrified brick. A 10-inch concrete base, $1\frac{1}{2}$-inch sand cushion and 5-inch vitrified block, cement filled, were the features of the specification.

What possible reason could be advanced for the use of a 10-inch concrete base?

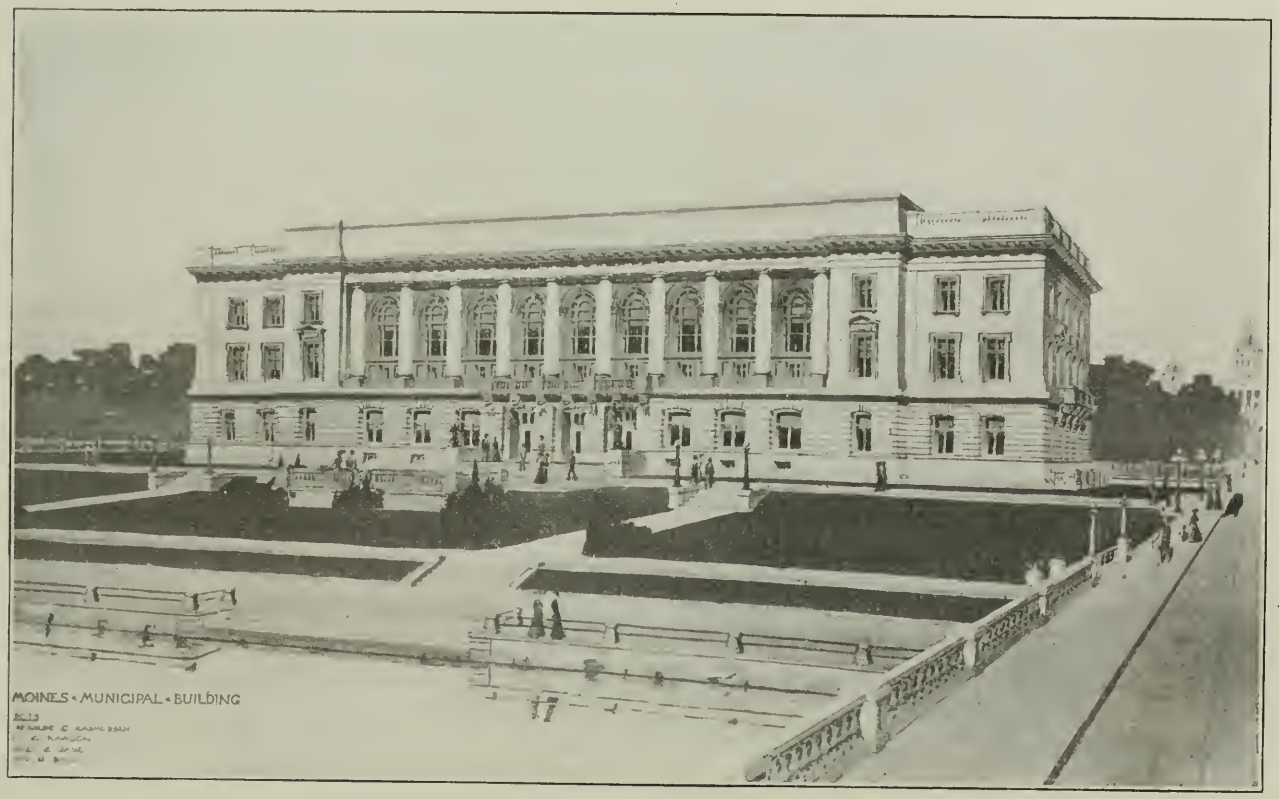
Why the 5-inch block in such a city?

Why the 10-inch concrete base?

We are not, however, calling in question such a specification because there is any lack of merit. In these two particulars the specification was simply overdone; but we do question the extraordinary expenditure enforced by this specification in view of what followed in the application of the cement filler.

A member of the board of public works was found upon the street supervising the construction. He permitted the expansion cushion to be poured in prior to the application of the cement filler. This hot liquid ran back into the joints more than three bricks length, subsiding, in many cases, one-half of the height of the brick. In the application of the cement filler it was allowed to be mixed in a box that of necessity was up-ended slowly in floating out the mixture upon the pavement. As it reached the upright position in this operation, a man, detailed for the purpose, threw a bucket of water into the box each time, so that a portion of the sand, going out of the box last, went out entirely cleaned of cement. The sand was put into a wheelbarrow and wheeled to these boxes; the proportion of sand was greater than one-half (at least an uncertain quantity), because it was not measured. A sack of cement was then put into the box and the same only stirred three times over with the hoe. In no instance was it brought to an even shade by the mixing process. The water thrown into the box while in its upright position only assisted in washing the cement to the gutter, so that in the gutter and into the place for the expansion cushion went the mixture of almost pure cement, while

*A paper before the American Society of Municipal Improvement.



II. PERSPECTIVE OF NEW MUNICIPAL BUILDING, DES MOINES, IOWA.

the crown of the street was filled with a mixture not richer than four parts of sand to one of cement; in certain parts not even so rich as this, and owing to the large quantity of the mixture deposited on the street at one time, and the water flowing promptly to the gutter before it could be swept in, it left the mixture thick enough to bridge the interstices, so that many of them were not filled at all. The use of the squeegee at angles of 45 degrees seems not to have been suggested at all to prevent hollowing out the interstices.

Even a member of the board of public works contended that the application of the expansion cushion as mentioned was required by the specifications under which the street was being built, but an examination of the specifications showed them to be correct and the board member wrong. From the ignorant manner of putting in the filler the disastrous results could readily be observed, even while the work was going on. But the incongruity of the affair, such lavish expenditure of the taxpayer's money on the one hand and such woeful ignorance on the other—yet all this in a vigorous American city of unusual thrift and intelligence. The condition of that street even one year hence is perfectly apparent through this operation, the cement bond having already broken on a portion of the finished street. In less than one year the whole street will be in a far worse condition than it should be at the end of twenty years' use.

Contrast, if you please, the condition of this work with that of the five-year-old finished street, Jennings avenue, Cleveland, O. Though utilized by two street car tracks, its beauty, utility and satisfaction as a city street and the extraordinary care and skill with which it was constructed are scarcely possible of description. Its very sight is inspiring. You can cross and recross the street without any knowledge of the car tracks, if you but close your eyes. Not a single wave, depression, jolt or jar discernible, either to the eye or by use of the street. The foundation is but 6 inches and the brick are but 4 inches in depth, and, although the traffic is four or five times that of the street just mentioned, its five years in use have in no wise reduced its worth. It bears every evidence and every promise of 100 cents on the dollar in value at the end of ten or fifteen years in use. If it were possible to afford a critical examination of that street on your part at this time, I do not think you would call me extravagant if I would say twenty-five years in use would not depreciate its value sufficient to call for repairs. In the one case may be found a sacrifice of $65,000 upon the altar of ill-considered plans and unskillful and ignorant execution. In the other, the investment of a like amount is maintained at full worth and answering its purpose completely.

In one of our larger cities another brick street was in construction. In this case the specifications were right. The concrete foundation was put in in fairly good condition, but should have been much smoother. The sand cushion was not compressed and was much intermixed with sticks, wood and broken stone. The brick were dropped into the street regardless of best edge up. The provision for expansion was a board 5 feet in length, $3\frac{1}{2}$ inches in width and $\frac{3}{8}$ of an inch in thickness. The board was taken out and the expansion cushion even poured before the rolling of the brick, preceded, however, by the filling of gravel in the crevices at least one-half way up the brick, to prevent the roller from closing the opening entirely. The rolling began at the crown instead of the gutter. A husky, muscular fellow was delivering the portion of sand in a wheelbarrow, while a physically weak and decrepit one was delivering the cement. The proportions corresponded to the individuals doing the work. This mixture of sand and cement was made upon the sidewalk, shoveled dry upon the street, shot at with the hose. Most of the cement went into the sewer. This was overseen by an inspector in constant service for the city, supervised by an engineer, but all characterized and dominated by an ignorant contractor, in constant complaint with the citizens and officials to the effect "that it was impossible for him to make a good street, being compelled to use brick that were for the most part culls;" yet in truth and in fact I have never seen a better delivery of brick anywhere.

The engineer was not the commander, but the menial, so servile that his suggestions were met with virulent abuse from the contractor—yet this job involved an expenditure of not less than $100,000.

Suppose you, under circumstances of this sort, that satisfaction could be guaranteed, and that the money was not thrown away? But the tension and irritation of this experience was greatly relieved by another experience, but not in the same city, yet where a like contract was being executed. At its very inception the engineer, deputies

III. COUNTING ROOM FOR ALL DEPARTMENTS IN NEW MUNICIPAL BUILDING, DES MOINES, IOWA.

and inspectors were upon the ground. Intelligence and sound judgment were exercised in every detail, and, though the contractor stormed and fumed, he soon realized that he was bound, hand and foot, to the specification as it read. Neither argument, abuse nor irony affected in the least bit the attitude of the engineer. The contractor, in less than one hour, reversed his disposition and skillful results followed, yet no more and no less was expected or required of this contractor than that which was written in the specification. The cost of the improvement was about the same in the aggregate as the one mentioned preceding, but the taxpayer got value received, dollar for dollar.

A picture of future results is fully and fairly illustrated by what was observed by the committee on brick paving from this society in a little trip taken by them in July, in the condition of Linn street, Cincinnati, and that of Holmden avenue, Cleveland. Each about the same length of time in use, of similar brick and similar use, but what a difference by contrast in the present condition! Measured by money value, a difference of about 90 per cent., but that difference as found to-day was simply the difference that might have been observed at the time the two streets, respectively, were built.

These observations, gathered fresh from the field within the past few weeks, seem extreme, but they fairly represent the ebb and flow of the tide in character and practice of municipal work, and, while these illustrations involve only brick street construction, such conditions are not confined to brick street construction alone, but permeate all branches of municipal work, and to an extent that is absolutely alarming and afford a black spot upon municipal government in this country.

Is it not, therefore, the duty of every patriotic citizen to change this state of affairs? Is it not the duty likewise of every engineer to eliminate from his profession everything that attaches to, confronts, hinders or delays the exercise of professional duties in the most advantageous way for the benefit of the public welfare? How may this be done? We may be sure it never will be done by efforts outside the profession. It may be inaugurated, insisted on, even demanded, on the part of and by the profession itself, for professional practice does not end with plans; it terminates only with execution. Cooperation and sympathy on the part of the public must be obtained in order that our own efforts shall be effective to the end sought. A remedy for these conditions must be sought for personally, individually, by the engineering profession and by the combined influence of just such organized force as that of the American Society of Municipal Improvements. In fact, it is right and proper that this society shall go down in history as the one society taking the lead in this matter, for here we have the combined influences of professional engineers, of municipal officials, and those whose business it is to serve the public through them.

I wonder if the lights of the General Electric Company would at this time have been developed to that world-wide extent if the manager had sat in his chair, and taken on, as assistants to his leading engineers, help based on recommendations of personal quality alone. Rather, have they not succeeded by seeking out almost entirely a class of thoroughly trained collegiate engineers, who could readily grasp every detail of their work, and thus be able to soon acquire efficiency in their service? The engineer in such an institution may be heard attentively by the hour, in the urgency of his suggestions toward perfection and the adoption of detail, which has contributed so greatly to the success of our commercial enterprises. In municipal matters, more in the past than in the present, "Mike" or "John" or "Jim" was chosen to assist the engineer because of his acquaintance and political influence in his ward, and this, and this alone, is his recommendation.

"You must get along as best you can with the men we furnish," comes the order from higher up to the municipal engineer. "The ordinance of the council prevents my writing the specification as it should be written; my hands are tied; McDougal & Flannagan must have this contract."

These are the hindrances to the reforms suggested and these are the hindrances that must be removed, and these are the hindrances that will only be removed upon demand by the engineering profession of America. When shall this be done? I say now! The sear is being rubbed off the public conscience, and it is now in better condition to receive the medicinal dose than at any time heretofore. You who are simply city officials join hands with the engineers in a resolution from this body that shall reach to the core of the evil.

IV. POLK COUNTY COURT HOUSE, DES MOINES, IOWA.

The Economics of Modern Highway Engineering*

By Prof. Arthur H. Blanchard, Consulting Highway Engineer, Brown University, Providence, R. I.

THIS discussion of the economics of modern highway engineering will be restricted to the consideration of the general situation relative to the economical use of the various methods employed in the construction and maintenance of roads and streets subjected to modern traffic.

One of the most important problems confronting every highway engineer today is the determination of the most economical and efficacious methods of construction and maintenance to be employed on the various roads and streets for which he is responsible.

The rapid increase in the rate of adoption of the motor vehicle, both passenger and commercial, has materially complicated the problem in many instances. Unfortunately, some of the basic principles of economical highway design have been forgotten or at least neglected in the strenuous endeavor to abate the dust nuisance and construct a surface which would not be disintegrated by either horse-drawn vehicle traffic or motor car traffic.

That the economical solution of the problems is rendered difficult by the lack of sufficient scientific data based on practical experience is self-evident. Nevertheless, present practice is susceptible of marked improvement, as there are to a certain extent limiting conditions governing the use of practically all of the various types of surfaces and pavements. By those conversant with the practice throughout the United States in the use of bituminous materials and the various dust palliatives in the construction and maintenance of roads and streets which have received attention because of the disintegration of the surface by motor car traffic or from the standpoint of dust prevention, it will be readily admitted that the employment of the method and material economically adaptable to local conditions is the exception rather than the rule.

If the conception of any engineering problem is not based upon the fundamental principles of the science pertaining thereto, and if all the multiple interdependent variable factors are not given due consideration, its successful solution is practically an impossibility.

Before citing several instances of uneconomical and economical solutions, it seems necessary, in order to avoid a misunderstanding of technical terms, to define two phrases which will be employed in this discussion. The term bituminous pavement will be used to designate a road having the upper course constructed by either the mixing or penetration method in which a bituminous binder is employed, while the phrase bituminous surface will be used to imply a thin bituminous coating or film on the surface of a road or pavement. Superficial tarring, the application of tarred sand or tarred chips and the use of all kinds of asphaltic coatings will come under this designation.

As the first illustration will be cited the case of the adoption of a bituminous pavement which would cost 40 cents per square yard over and above the cost of ordinary macadam for a street which could have been economically maintained, if properly built of ordinary macadam, and treated annually with a light application of either an asphaltic or a tar cmpound. The first application might cost from 4 to 6 cents per square yard, while the annual application and repairs thereafter would amount to a yearly charge of from 3 to 4 cents per square yard. Until it is fully demonstrated that the type of bituminous pavement mention above has a life of more than ten years under the conditions noted, and that the annual average maintenance charge will not be greater than one cent per square yard, the advisability of selecting ordinary macadam with a bituminous coating is not debatable from the standpoint of economical maintenance. If, however, it had been possible to construct a bituminous pavement at an excess cost of 12 cents, as the writer was able to do as late as 1908, while deputy engineer of the Rhode Island State Board of Public Roads, it would have been self-evident that this type of construction would have been preferable from the standpoint of economics, provided that the pavement had a life of five years, which a recent examination indicates as a conservative estimate. Engineers interested in the economical relationship between a pavement and ordinary macadam will find an able treatment of the subject under the heading, "Comparison du Pavage et de l'Em-

*A paper before the American Society of Municipal Improvement.

V. ORNAMENTAL AND BUSINESS LIGHTING ON WALNUT STREET, DES MOINES, IOWA.

pierrement au Point de Vue du Prix de Revient Annuel," by M. H. Heude, inspector-general of the Department of Roads and Bridges of France. The above paper was published in the Annales des Ponts et Chaussees for 1908.

The indiscriminate advocacy of bituminous pavements for all classes of roads and for many classes of city streets which are subjected to motor car traffic is as unsound as the contention of some engineers that the periodical application of light oil to the surface of a macadam road is a satisfactory and economical prescription for the preservation of the surface and the alleviation of the dust nuisance, irrespective of the location of the highway and the amount and character of the traffic to which it is subjected. Between the above limits are found many conflicting opinions which will not bear the searchlight of the investigator.

What are the reasons for the present situation in many localities in the United States? Why is not the practice of some of the leading municipal and county engineers of England duplicated in every state, county and city throughout this country? The writer has in mind one county adjacent to London whose engineer, after considering the design of a given section of highway with the same care and deliberation which characterizes the work of American engineers when designing a mile of railroad or a bridge, is able to determine within reasonable limits whether it is economically advisable to use a wood block pavement, a bituminous pavement constructed by the mixing method, a bituminous pavement constructed by the penetration method, an ordinary macadam road with a bituminous surface, or merely an ordinary macadam road. As a result, all the various types of roads and pavements mentioned above are found on the main trunk lines in this county, each used under conditions where it is economically adaptable in view of the present knowledge relative to limiting conditions. An investigation of current highway engineering practice throughout the United States will reveal the following characteristics, all of which are applicable to some localities, while one or more are influential in shaping existing conditions in many instances:

First—Political interference in the selection of the men placed in control of highway work and with the work of design, construction and maintenance of roads and streets.

Second—The interference by controlling bodies of laymen in the legitimate work of the highway engineer.

Third—Division of responsibility in the supervision of highway work, particularly in municipalities, but also applicable to some states, as, for instance, those in which the state department supervises the design and construction, while the responsibility for maintenance is based upon the county or town.

Fourth—The comparatively small number of well-trained highway engineers who have devoted the requisite time and energy to the many new problems which have arisen during the last decade.

Fifth—The comparatively infinitesimal amount of investigation which has been considered necessary as preliminary to the design of a road or street or a system of highways. This condition is due to a lack of appreciation of the relationship existing between the results of such investigation and the economics of construction and maintenance. Even when such relationship is recognized by the engineer, the controlling body rarely allows sufficient time or is willing to grant an adequate appropriation for a thorough study of the problem.

Sixth—The general meagerness of detail knowledge of the many different materials on the market and the varied methods in connection with which they may be used. The engineer must not confine himself to a consideration of the crude and many times expensive methods which have been in vogue, but must base his decision on the use of the most economical method of performing the work, which naturally will include an investigation of all machinery adaptable to this class of construction work and of the practicability of designing new apparatus suitable to the case under consideration. It is likewise desirable that the engineer should have a wide acquaintance with methods and materials used in both the allaying of dust and the construction of bituminous pavements and surface, which knowledge has been secured through other channels than by a perusal of the advertising literature with which the country is flooded. At the present time, when the chemical and physical analysis of bituminous materials and the effect of the various properties on the adaptability of the material for use in the construction and maintenance of roads and streets is in its infancy, it is not to be expected that the engineer will be able to draw up specifications for every case which will secure the most economical and efficacious material for the purpose, and at the same time eliminate all undesirable materi-

als, but, on the other hand, in view of the progress which has been made during 1909 and 1910, the number of mistakes should be materially reduced.

Seventh—A confusion of ideas on the part of many as to the reasons for the success or failure of various methods, considered both from the standpoint of road preservation and dust prevention. For example, a bituminous pavement built by the mixing method, with the most efficacious binder manufactured, may disintegrate within a year after construction, due to the neglect of but one item, for instance, that of preventing a layer of dust from accumulating on the surface of the bituminous coated road metal before the same is rolled. Failures of this type of pavement are usually laid to poor binding material, while in reality there are a score of reasons for unsatisfactory work of this type. It is well known that many kinds of bituminous pavements, under certain conditions, are very dusty, due to self-evident reasons. If the traffic consists largely of horse-drawn vehicles and the adjoining streets are of ordinary macadam, it is useless to expect a street protected from the action of the wind and bordered by trees and curbs to be free from dust without artificial cleaning or the application of some form of dust palliative. The dusty condition of many bituminous pavements and bituminous surfaces on our city streets has, unfortunately, led to the conclusion that bituminous pavements and surfaces are not dustless under any conditions. To those who have motored over hundreds of miles of bituminous surfaced roads which were dustless the above opinion, so commonly expressed, appears absurd. One other illustration will be mentioned. In certain cases the periodical watering of macadam surfaces has proved efficacious, both from the standpoint of laying the dust and as a road preservative. Based on the above results, some engineers have advocated ordinary watering as a universal remedy for all classes of macadam roads and streets, irrespective of the traffic to which they are subjected or a consideration of the economics of the public.

Eighth—Many authorities are seeking for a panacea for the treatment of all classes of roads and streets. It must, however, be constantly borne in mind that it is impossible to treat economically all highways by the same prescription, just as it would be considered to-day absurd to follow the former practice of some of the municipal engineers of the old European cities and pave all of the streets with stone blocks.

Ninth—Non-observance of the relationship between the adaptability of various methods and the variability in the cost of labor and materials, and the accessibility of new bituminous materials and machines.

The self-evident desirability of a thorough discussion and an exhaustive study of the economics of modern highway engineering influenced the writer to prepare this brief presentation of the status of the administration, design, construction and maintenance of roads and streets subjected to modern traffic.

Parks and Play Grounds in South Park System of Chicago*

By H. S. Richards, Assistant Superintendent

PERHAPS no civic undertaking within the last decade has been of greater value to the people than the development of the small park movement, with all that it implies in the way of more ample facilities for the health, recreation and even education of both young and old. The "public playgrounds" have become an indispensable factor in the life of today.

By the establishment of widely scattered parks and squares of moderate size, these breathing spots are gradually being brought within walking distance of the entire population. The South Park Commissioners of Chicago carefully collected all data bearing upon the subject, and made a systematic study of the problems involved. Prior to 1903, however, their hands were tied, and they could only pursue their investigations and await the day when the statutory bonds which held them should be released.

The Board of South Park Commissioners is a distinct corporation in no way related to the city or county government. The Commissioners fully realized the necessity for building a greater number of parks, large and

*A paper before the American Society of Municipal Improvement.

small, but they were prevented by law from acquiring land which did not adjoin existing parks and boulevards.

Between 1869, when the South Park district was created and the year 1903, the population of Chicago had grown from 298,977 to 1,873,880. Populous neighborhoods had sprung up at points remote from existing parks. In many of these neighborhoods, the residents were practically prohibited from enjoying the park privileges by reason of the distance of the parks and the cost of reaching them. To more than half the population of the South Park district the parks were not easily accessible. Great sections, like the Stock Yards, Calumet and Englewood districts were wholly without parks.

By an act of the Illinois legislature in 1903 the limitations were removed and the Commissioners at once entered upon their task of selecting sites for new parks, proceeding with judgment and rapidity. In writing of their work, Andrew Wright Crawford said: "The fourteen recreation centers (of the South Park district of Chicago) recently established unquestionably constitute the greatest advance in the use of parks that has been taken in any one year by any one city."

Great care was employed in the selection of sites adequate to the needs of the districts to be served. It was borne in mind that the training of citizens cannot proceed advantageously in parks so cramped that it is necessary to herd the people together like cattle. As a basis for all negotiation, the valuations of the Valuation Committee of the Chicago Real Estate Board were employed. In no case did the purchase price exceed the valuation fixed by the committee.

Armour Square, consisting of ten acres in one of the most congested districts of the south side, cost $220,000, of which $50,000 was expended for land, $94,000 for buildings and swimming pool and $76,000 for improvement and equipment. For the two and three-fourths acres of Mulberry Bend Park, New York paid $1,500,000, while Seward Park, two and five-eighths acres in expanse, cost $2,500,000.

Within a year after the power was given them, the South Park Commissioners had acquired sites for twelve new parks and squares. (All areas of ten acres or under are called squares.) Today there are nine large parks, ranging from 60 to 540 acres in area, embraced within the South Park system, and fifteen smaller parks, of 7.4 to 40 acres. Five of the new parks are still unimproved, while work is in progress on a sixth.

With the acquisition of the small park sites a new problem presented itself. Groups of buildings were to be erected. It was deemed desirable that these buildings, in order to be of the greatest value to the community, should combine architectural interest and propriety with utility. Little had been done in public works in America in the promotion of landscape architecture. The approaches to some of the best public buildings are dull. This the Commissioners realized, and they were impelled to employ the most expert skill available, with the result that the Chicago playgrounds are distinguished by a type of landscape architecture which may properly be regarded as notable in many respects.

The "field houses" have been constructed of concrete. The roofs are tiled and have a heavy overhang. Their general effect is Spanish and all details of design are harmonious throughout. Ornamentation has been used sparingly and has been made an integral part of the walls, whenever used, rather than an appendage thereto. With an eye to the future needs of a rapidly growing city, the buildings were made of generous size, anticipating the increasing demands upon these neighborhood centers. Notwithstanding the policy of the Commissioners is to provide adequately, in some cases the patronage has been so tremendous as to require remodeling and enlargement even at this early day. As a result of this experience, the building now in course of construction in Park 4—the newest park to be improved, is to be much larger than any of its predecessors.

Armour Square, named after Philip D. Armour, "philanthropist and captain of industry," and bounded by 33rd and 34th streets and Shields and Fifth avenues, may be taken as typical of the small parks. The field house contains two indoor gymnasiums, one for men and boys and the other for women and girls. The dimensions of the men's gymnasium are 32 feet 4 inches by 72 feet 5 inches. It contains 508 steel lockers, 8 shower baths and has a plunge pool 20 feet by 8 feet in area. The women's gymnasium is 34 feet 4 inches by 60 feet 5 inches in size and has 180 steel lockers, 28 dressing booths, 6 private and 8 open shower baths. The plunge pool is 19 feet 6 inches long and 9 feet wide.

There are three outdoor gymnasiums. The men's is 236 feet by 125 feet; the women's 110 feet by 120 feet and the

children's 130 feet by 80 feet. They all contain adequate modern equipment of substantial construction. The park has a running track of six laps to the mile. It also has baseball diamonds. In the field house, in addition to the gymnasiums, there is an assembly room, a club room, a reading room, a public library station, and a refectory. There is also an open air swimming pool, 50 feet by 88 feet in size, this being the smallest of the ten swimming pools under the jurisdiction of the Commissioners. The other swimming pools vary from the above dimensions, as a minimum, up to 80 by 150 feet in size with from 100 to 225 dressing booths for the swimmers.

All of the park gymnasiums and playgrounds are in charge of trained instructors, under a director of gymnastics and athletics. During the school year the gymnasiums and playgrounds are open from 3:30 p. m. until 10:00 p. m. The swimming pools are open from about June 1st to October 1st. Two days of each week are reserved for women and girls. The shower baths and plunges are in constant use. The buildings are open seven days in each week. Men, women and children make steady use of all the facilities afforded and reservations for the assembly room are made months in advance.

Among the manifold facilities offered the patrons of the parks are two golf links, one of 18 holes and one of 9 holes, with a clubhouse, lunch room and locker and shower bath rooms for both men and women. There are 24 football gridirons, 148 tennis courts, 32 baseball diamonds, 17 skating ponds with warming houses, as well as rowboat liveries and launch service wherever lagoons make such service possible. Every form of athletic competition is fostered, from wrestling and fencing to archery, roque and fly-casting. Neither expense nor pains is spared to give to the humblest patrons of the park the best equipment that modern ingenuity can solve. When the first roque court was opened, for example, weeks were spent in experimenting with various forms of cushions to improve the accuracy of the play. The courts themselves are of concrete, as level and as true as a billiard table and the most scientific contests are possible. At present experiments are being made with various forms of tennis courts. A composition of asphalt and cork is being tried, which promises to permit extremely fast play, while avoiding the hard and unyielding surface of concrete or clay courts.

During the year 1909 the citizens of Chicago and their families made use of the park facilities as follows: Swimming pools patronized by 758,149 persons; shower baths, 1,212,421; indoor gymnasiums, 302,222; outdoor gymnasiums, 1,943,228; assembly halls, 246,660; reading rooms, several of which are branches of the public library, 637,683. Casual spectators are not included in these counts. No charge whatever is made for bathing suits, soap, towels, lockers, gymnasium instruction or, in fact, for any service except refreshments and boats.

The cost of maintenance of each of the small park's recreation facilities averages $30,000 per annum, which sum includes supervision, policing, gymnasium instructors, attendants, janitors, lighting, heating, swimming pool service, repairing and painting buildings, care of grounds and incidental expense.

No concessions are sold. Every phase of the park's activities, to the smallest item, is under direct control of the Commissioners. All repairs and new construction are done by the park employees. The Commissioners maintain repair shops, laundries, an ice cream factory and a 35-acre nursery.

With each passing year the Commissioners are themselves doing a greater proportion of the new paving on the driveways of the system. The two portable asphaltic concrete machines in use last year have been increased in number to three, the third of which is of smaller capacity and designed for patching. With this battery of portable plants, approximately 300,000 yards of paving have been laid at an astonishingly low cost. The two larger machines have together turned out material for 2,700 yards of paving per day.

In conducting the activities of the parks, the Commissioners have had a higher object in view than the mere supplying of amusement to the masses. The effect upon the manhood and womanhood of the patrons of the parks has been constantly in mind. The results of park environment and influence have been definitely revealed in repeated instances. Bath tubs have have been installed in homes where they were unknown before the advent of the small parks with their shower baths, and the gymnasium discipline, under the conscientious direction of skilled instructors, has not failed to leave its impress upon the characters of countless young men and women. As a municipal investment, the Chicago small parks are already paying handsome dividends in better citizenship.

Some Modern Features of City Goverment and Legislation *

By Samuel A. Freshney, Secretary and General Manager, Board of Works, Grand Rapids, Mich.

LEGISLATION, as applied to municipalities during the past few years, has tended almost entirely toward giving to cities a larger measure of home rule. This is entirely as it should be. The people of any city are more competent to judge of what laws are best suited to their particular needs than any legislature can possibly be. This is especially true when we remember that most legislatures are very largely dominated by farmers. However, home rule has not been the only legislation enacted as applied to cities. The wave of conservation which is sweeping the country has been manifested in almost all legislatures. The result has been more strict provisions covering franchises, more rigid measures governing the acquiring of water power rights, and more stringent laws relative to bond issues and capitalization. Few states now permit the granting of perpetual franchises. Most states are holding on to water power rights, and laws prohibiting watering stock and excessive capitalization are becoming general. With these general legislative acts have come more carefully drawn local acts; with home rule has come local legislation tending toward a greater centralization of administrative authority in cities.

The Des Moines commission plan of government has found much favor and many converts. Many cities have adopted charters very similar to the Des Moines plan. To me, however, it does not seem that the commission plan is the one to survive. Already there are signs of the passing of the wave in this direction, although its influence is left in a trend toward smaller legislative bodies and more centralized administrative authority. The very legislation which has given home rule to cities is destructive of the commission form. It is but a very short step from home rule for cities to similar rule for subdivisions of cities. Home rule places in the hands of the people themselves the decision as to the form of government. It takes from the hobby-riding few the power to give to a city a commission form. The people in general, the workingmen in particular, do not look with favor upon any plan of government which makes the legislative body of the city less directly responsible to themselves. For this reason it is likely to be much harder to elect aldermen at large than to elect them by wards. The people like to have a man who resides in their very neighborhood, to whom they can go for such legislation a sthey desire, and whom they can hold responsible for whatever is done that does not appeal to them individually.

In the small commission, elected at large, the workingman seems to see a local autocracy, for which he will in rare cases vote, but this same workingman is not blind to the disadvantages of an unwieldy body; therefore, under home rule, the people will seek a smaller legislative body, but will at the same time insist that that body be elected by wards or districts, and be held directly responsible to the electors.

The workingman in the same manner recognizes the great advantages of centralized administrative authority. He wants men in charge of the various departments of the city to whom he can go, knowing that he is going to the right man. If there is a hole in the street, he wants to know just what one man has the authority to order that hole filled up. If he wants a fire alarm box located on the opposite corner, he does not like to be sent around from one office to another to find the man who is clothed with the authority to order that box installed. Nothing so arouses the wrath of the average workingman like being sent from one office to another, being told at each, "Now, I have nothing to do with that matter; you will have to go to so and so." He wants to know just what one man is in authority over that particular department, and he wants to reach him without delay. This one thing has made the board system of government somewhat unpopular. Theoretically this system is absolutely correct. When it was first adopted, but a few years ago, it was at the height of its popularity and many cities adopted it. In most cases the mayor has the appointing power over the members of these boards; he named one member each year. It was believed that by having one member from each board retire annually, the element of politics would be kept out. This proved true to a considerable extent, but the fact

*A paper before the American Society of Municipal Improvement.

was overlooked that there is great danger of conflicts between the boards and the legislative body. Personally, I believe that the board system of government has been fairly satisfactory, all things considered.

With home rule smaller legislative bodies and greater centralization of administrative authority, come a still further taking of the reins of government in hand by the people. They now demand the right of initiating the right of legislation, to have the final say as to whether legislation shall become operative and to pull back into private life the official who does not give satisfactory service.

The initiative, referendum and recall have long been agitated by certain men, but not until recently have cities adopted them to any great degree. The referendum was first put into execution as relating to franchises. The general awakening of the country to the great value of franchises and the general demand that all franchises should yield a return to the municipality, resulted in a demand on the part of the people that they should say finally whether the franchise should be granted or not. In most instances, the legislative bodies were only too willing to leave this question up to the people. When the people voted that a franchise was right, the legislative body was relieved of all responsibility. Every community has it quota of men who will cry "steal" every time a franchise is suggested. They do this without reason, usually without knowledge or ability to absorb knowledge. The cry "steal" goes far with the people, and many a city may have refused a franchise which was for its own good, simply because the mass of the people were misled by the cry of "steal." This is the danger of the referendum. I believe the dishonest officials are the rare exceptions, and I am optimistic enough to believe that dishonesty has not gained such headway in this country that whole legislative bodies, surrounded as they are by the safeguards of executives with veto powers and newspaper reporters seeking the first sign of a dishonest act, that many great "steals" are likely to be pulled off. Therefore I believe the legislative bodies are in general perfectly capable of securing in franchises provisions valuable to the people, but when the people are misled by the set of persons who unreasonably, unjustly, and ignorantly cry "steal," they have only themselves to blame if they find out afterward they have turned down a good franchise.

The initiative was next to be received, most cities now recognizing the right of the people to demand certain legislation. Even cities that have no such provisions incorporated in their charters, recognize the principle by enacting legislation which is demanded either by the newspapers, or by a petition of citizens, or by simple request.

The recall is still on trial. It seems to be growing in popularity. It must, however, be surrounded with proper safeguards. If an official is dishonest, incompetent or negligent, it is only right that those who have placed him in office should have the power and the necessary machinery to recall him. But the danger lies in a recall law so easy of operation that for some temporary unpopularity an official may be recalled or forced to go through a campaign incurring expense and hard work. Therefore I say the recall must be properly safeguarded. As an instrument of protection against dishonesty or incompetence it is right, but a succession of elections and changes in office, such as Los Angeles recently went through, should be avoided.

Municipal ownership of public utilities is a question attracting more and more interest daily. For years most cities have owned and operated their water works systems and street lighting plants. Modern science has brought the garbage destruction problem and the street railway problem before the people. In general, it seems the garbage problem is best handled by the municipality. This is particularly true of garbage collection, while destruction might possibly be handled satisfactorily by private corporations and without expense to the city. Public ownership of street railway and gas plants and commercial electric lighting plants, is open to argument. With the vast operating expense and heavy maintenance costs of either of these public utilities, and considering the enormous difficulties in keeping politics out of municipal operation, I believe that public utilities outside of water works systems and street lighting systems should be operated by private individuals, and controlled by the municipality by close and consistent regulation.

Water works systems and street lighting systems are strictly necessities and are not operated for revenue; while commercial electric lighting and power and gas and street railway systems come under the head of commercial enterprises, and this, in my opin-

ion, should not be within the province of the municipality.

The tendency of American times is toward municipal ownership; the demand goes up from every section of the country, and it constantly embraces new enterprises. It is my firm conviction that this tendency toward municipal ownership is fatal to American institutions, and American municipal government, unless coupled with a tendency toward a reduction of public affairs to an absolute business basis.

All practical, public problems must be shorn of their political significance and brought to a moral plane; and moral ethics in public affairs are just plain, ordinary, square-deal business ethics.

It is much easier to be critical than to be correct, and perhaps I have only pointed out the trouble without suggesting a proper remedy; but, frank admission of the real cause at fault, and frank consideration of the possibilities of reform are the only methods upon which we can rely for better government.

Report of Sub-Committee on Brick Paving of American Society of Municipal Improvement

By Edward H. Christ, Member of Board of Public Works, Grand Rapids, Mich.

GRAND RAPIDS laid its first brick pavements about twenty years ago. Since that time we have tried every method known to improve them.

Fortunately, our charter gives the board of public works absolute control of how a street shall be constructed, after the same has been ordered by the council. This gives us the opportunity of taking advantage of every proposed suggestion that would improve our pavements.

We are now constructing pavements practically along lines recommended by the No. 1 specifications of the National Paving Brick Manufacturers' Association, in order to determine their good and bad features. Considerable objection has been made to certain particulars in these specifications (which our inspectors and contractors call frills), such as rolling the sand and using a template to spread the same, also in the manner of applying the filler. But after careful consideration and investigation, I think these requirements can be done better, cheaper and with less experienced help, by following the specifications.

The brick manufacturers are very much dissatisfied with the present rattler test, and are designing one which it is hoped will give a uniform test.

Specifications for this rattler were promised to the Organization of City Officials for Standardizing Paving Specifications, not later than August 1. Unfortunately, the channel plate they intended using for staves proved to be unsatisfactory.

In a recent letter from Mr. W. P. Blair, their secretary, he said they expected to have a report to make at this meeting, also a rattler on exhibition, which, with the report, will disclose the progress so far made.

There is no question but what tests in the past have not been uniform, although in the larger cities I do not think the difference has been as great as in the quality of the brick furnished by the manufacturers.

Without a doubt most engineers would prefer to have the manufacturers design the rattler, as it will eliminate all criticism now advanced by them regarding the manner in which present tests are made, and will put it squarely up to them to furnish brick that will fill the requirements specified.

When the new rattler is perfected it will be the duty of the committees of the different societies to make a series of tests to enable them to decide upon the per cent. of loss they would recommend.

In our city we have taken two samples of brick from each car received this year; one of them is being tested in the rattler we are now using; the other in the proposed new rattler. This will enable us to note the relative difference between the two rattlers.

Not until cities construct their brick pavements under a standard specification will it be possible for any one to account for the many defects now noticed, because conditions are different in the various sections of the country.

The majority of this committee are also members of the brick committee of the Organization of City Officials for Standardizing Paving Specifications, and it is hoped we will be able to present a complete specification to that organization at its next meeting, to be held in New York City, January 10 to 14, 1911.

EDITORIAL COMMENT

Standardizing Specifications.

The Standard Rattler for Testing Paving Brick.

STANDARDIZING SPECIFICATIONS.

Perhaps the most important action taken by the Erie convention of the American Society of Municipal Improvements was the adoption of an amendment to the constitution making its committee on standard specifications one of the regular standing committees and placing it in charge of the whole field of specifications for municipal work, with power to appoint sub-committees. If now, this committee is put in charge of an energetic, broad-minded man, thoroughly acquainted with the municipal field and the experts in that field, it can make a deep impression upon future municipal engineering practice.

That such a committee is needed was recognized last year, when the first special committee on this subject was instituted, but there seems to have been much misunderstanding by the officials of the society of the intended scope of the committee, and the committee itself waited too long for the action of the Chicago convention for standardizing paving specifications to do any work itself. Late in the summer the chairman appointed a number of special committees, mainly on paving specifications, although this was but one portion of its field. But four of these made reports at the convention and they had not been considered by the general committee before presentation. They were received and filed for further consideration by the new standing committee and the society.

That the movement was slow in starting is shown by the interest in the Chicago convention last February, called to standardize paving specifications. This convention resulted in the formation of the Organization of City Officials for the Standardization of Paving Specifications, an organization which limits itself to but one portion of the field placed in charge of the new standing committee of the A. S. M. I. This organization meets again in January to review and extend its work of last winter. Its life will probably be limited if its title is not broadened, and, in fact, it should be merged in the A. S. M. I., where it can use the force and prestige of that society and have the steadying influence of its conservative temperament. Many city officials are members of both organizations and recognize after their study of the situation the logic of this position. But one obstacle to this combination of forces has been mentioned, an apparently unreasoning fear that if the newer organization should have associate members from among the men engaged in the supply of materials and the construction of works it might be unduly influenced by them or at least there might be suspicion of such undue influence. This fear was expressed in the discussion of the plan of the organization. Rather inconsistently, the organization provided for such associate memberships with dues so high that the outsider would be much disposed to question the motives of one joining under the present regulations if not of the organization in accepting him. That tightly drawn membership lines are not complete safeguards against outside influences has been demonstrated by past experience. The A. S. M. I. has encouraged associate membership within certain quite well defined limits for the undoubted benefits which result, and does not hesitate to draw its lines closely when there is any disposition to overstep them. No one fears any undue influence upon any action of the society whether from within or without.

There are several associations now in existence which have committees

considering standards of various sorts, whether of qualities of materials or workmanship, tests, specifications and the like, and they attack the problems from various points of view. The municipal engineer can use all the material developed by the other associations and may have some modifications of his own, made necessary by the conditions under which he works. The committees of the two associations particularly mentioned should, of course, work together so long as they maintain separate organizations, and they should co-operate with the committees in other associations whenever such bodies take up the same subjects for discussion. Perhaps these two are the only ones considering paving specifications as such, but nomenclature of bitumens, creosote oils, cements, cast-iron pipe, special castings, electrical standards, etc., etc., are taken up by one association or another and are all within the scope of the committee of the A. S. M. I. and its sub-committees. They will not do their whole duty unless they avail themselves of the studies of these other societies and bring the results into as close conformity with approved standards adopted by such societies as the requirements of municipal work permit.

THE STANDARD RATTLER FOR TESTING PAVING BLOCKS.

One of the most interesting features of the Erie convention of the American Society of Municipal Improvements was the history given by Prof. Edward Orton of the efforts to develop a standard rattler which would eliminate all the variations in results of rattler tests which may be due to the design or condition of the rattler. The general statement was made that the channel iron staves, which have been used quite generally, have not proved satisfactory as regards durability, the change in form and condition of surface being so rapid that the necessary frequency of changes of staves to insure uniformity of results makes the maintenance of the rattler very expensive. The most promising form at the present time is a 6-inch 15½-pound channel iron reinforced by a ⅜-inch steel plate fastened to the web with countersunk bolts or rivets. While this has not been definitely adopted as the standard form it will be unless unexpected difficulties arise.

Professor Orton stated that two parallel sets of tests had been carried on, one by himself in his Columbus laboratory and one by M. W. Blair in the Indianapolis laboratory of the National Association of Paving Brick Manufacturers. These tests were made in two rattlers made exactly alike, using 6-inch 15½-pound channel iron for the staves. The samples of brick used were obtained by one man from one factory and the 20 bricks in each sample were divided equally between the two laboratories and so marked that the results of the tests on the 10 bricks of a sample in one laboratory could be compared with those on the other 10 bricks of the same sample in the other laboratory. Chilled cast-iron cubes were used as the abrasion material in some tests and spheres in others.

When two sets of these samples had been tested, being some hundred samples in all, comparisons were made between the results at the two laboratories. It was discovered that there were nearly constant differences between the tests at the two laboratories. Thus the tests with cubes at one laboratory would show continuously higher losses from abrasion than the other, the percentage of difference being fairly constant. It happened that the results with spheres varied in the opposite direction.

This led to a study of the shot used and it was found that the differences in results from the two laboratories were due to differences in hardness of the shot, which in turn were due to differences in chemical composition.

In a third set shot of the same hardness were used in each rattler and the results came to a practical agreement. It is evident, therefore, that the specifications must include a standard composition of the shot used.

Spherical shot give more nearly uniform results than cubical shot, and therefore the spherical form will probably be made the standard.

Some of the members of the committees on specifications for brick paving of the associations of municipal officials are very anxious to have the specifications for the standard rattler completed immediately, and tentative specifications could be written at this time, but a number of questions of detail have not yet been settled and there may arise some such unexpected difficulties as that of the necessity for a standard hardness of shot.

Professor Orton gave a brief statement of the program for future tests to determine these details and it would seem to be prudence to wait for even a tentative specification for a rattler until these tests are completed and thoroughly checked. The general form of the specifications and approximations to most of the details are now available and, after so long a time of waiting, a few weeks more should not be unbearable.

After the standard rattler is defined will come the question of standards for abrasion tests of bricks, and of standard sizes for bricks and blocks. The former, at least, must wait until the rattler problem is solved. The first step toward the determination of the latter was taken in the resolution adopted by the A. S. M. I., asking the N. P. P. M. A. for its ideas regarding the possibilities of fixing standard sizes for bricks and blocks.

THE QUESTION DEPARTMENT

Dealers in Crushed Granite and Marble.

Will you kindly favor us by send to us the address of some company trom whom we can obtain crushed marble and granite?

P. & A., Zanesville, O.

The following are those nearest Zanesville whose names are at hand: North Georgia Marble Co., Talona, Ga.; American Crushed Stone Co. (granite), 2 Webster Ave., Chicago, Ill; Dolese & Shepherd Co. (granite), 184 LaSalle St., Chicago, Ill.; Wisconsin Granite Co., Chamber of Commerce Bldg., Chicago, Ill.; Petersburg Granite Co., 3 E. Lexington St., Baltimore, Md.; McClenahan Granite Co., Port Deposit, Md.; Booth & Flinn (granite), 1942 Forks Ave., Pittsburg, Pa.

Specifications for Expansion Joints in Cement Walks.

In the construction of sidewalk paving I am laying off the sidewalk in 5-foot blocks, and between these blocks I am using tarred paper to keep the blocks open and as an expansion joint. Some persons advocate a sand joint between the blocks and some advocate other kinds of joints. Now I wish you to let me have your opinion what is the best joint.

D. G. A., Baltimore, Md.

The standard specifications for Portland cement sidewalks of the National Association of Cement Users apparently assume two reasons for making joints in cement walks. One of these is the expansion of the walk, and the clause covering this is as follows:

In every 50 linear feet of walk at least a ½-inch expansion joint shall be provided. Any means which will provide this will be acepted.

Another is the localization of any movements of the walk, due to expansion, contraction, settlement, etc. This is covered by the following:

The slabs or independently divided blocks when not reinforced shall not have an area of more than 36 square feet or have any dimension greater than 6 feet. Slabs of more than 36 square feet shall be reinforced with ¼-inch steel rods, spaced not more than 9 inches apart, or with smaller rods or fabric of equal strength.

This construction usually prevents cracks in the walk, for any strains or movements are taken care of in the joints, thus relieving the blocks and greatly reducing the chances of cracks in the blocks on account of excessive strains.

The "Handbook for Cement Users" ($3), gives a number of standard specifications for laying cement walks, most of which provide sand joints entirely through the base and wearing surface. One set of instructions has the following paragraph:

Do not allow any block to bear directly against any solid body, such as stone curb, building, post, manhole rim, etc. Leave the same space (about ¼ inch) between pavement and such fixtures as is between the block themselves. This note applies to the base and top as designed to avoid cracks and chipping due to expansion and contraction from temperature changes. This space can be conveniently provided for by the use of thick tar paper or felt.

With respect to making joints in the walk, the standard N. A. C. U. specifications, above referred to, provide as follows:

After the wearing surface has been worked to an approximately true plane the slab markings shall be made. If joints have been provided in the base during construction or have been cut in the base prior to spreading the wearing surface, the markings shall be made with a tool which will cut entirely through the surface and completely separate the wearing surface of adjacent slabs. If joints have not been provided in the base they must be made with a tool which will cut through to the slab-base and completely separate adjacent slabs. The slabs shall be rounded on all surface edges to a radius of about ½ inch.

Another set of instructions advises laying the walk in alternate blocks. It continues as follows:

On the same day, as soon as the concrete has set, remove crooswise and center scantlings, place a sheet of tar paper on the edges to separate them from all other squares and fill in the spaces thus left with the base concrete. Mark the scantling to show where the joints come. The finishing coat should be spread on before the concrete has taken its set, and smoothed off with a screed or straight edge run over the scantlings. Smooth with a wooden float and groove exactly over the joints between the concrete base blocks so as to bevel the edges of all blocks.

One city specification provides that the concrete shall be laid in blocks of (given) dimensions with expansion joints separated by two pieces of 3-ply asphalt paper at each 33 feet of line; intermediate joints cut through as the engineer may direct. The wearing surface shall be cut in blocks the same size as the concrete base and directly over these joints.

A more detailed description of the method of laying blocks provides that the strips of tar or felt paper shall be ¼ inch thick and the same width as the thickness of the concrete foundation. There can then be no interference of the tar paper with the cutting and finishing of the joints in the wearing surface.

In general, therefore, it may be said that while the more common practice is to make the joints in the concrete base of a cement sidewalk by cutting through it with a proper tool and filling the cut with sand, it is also permissible to use tar, asphalt or felt paper to make these joints provided it is not allowed to interfere with the proper cutting and finishing of the joints in the surface coat immediately over, and connecting with, the paper joints in the concrete foundation.

The question of expansion joints is one depending somewhat on locality. The first specification given, of the National Association of Cement Users, is a safe one to follow, but it is more common practice to make all the joints expansion joints, making them wide enough to allow for expansion space of width equal as a whole to that specified in the Standard when taken as a whole.

Concrete or Vitrified Clay Sewer Pipe.

This city is contemplating the laying of an extensive sewer system, and I write to inquire of you where to look for the best information relative to the merits of cement and clay pipe. It is represented to our sewer committee that the glazed cement pipe made by the "Thomas" machine, manufactured at Tacoma, Wash., will disintegrate and that concrete sewer pipe has not proved satisfactory. The cement pipe is sold here for less than the clay.

If you will kindly refer me to books or articles giving me the desired information, your courtesy will be greatly appreciated.

J. H. A., Salem, Ore.

The relative merits of concrete and clay sewer pipe have been discussed quite freely of late. Unfortunately too much of the discussion has taken the form of attacks upon the one material by the adherents of the other, and the defective work with each has had more than its fair share of attention.

It is undoubtedly true that clays which are not suitable for sewer pipe have been used for that purpose and that such pipes have disintegrated and have crushed under the super-imposed weight of earth or rock. It is equally true that unsuitable materials have been used in making concrete pipe and that they have also disintegrated. Bad workmanship in making and laying pipes have had their effect in producing failures in sewers laid with clay pipes and in others laid with concrete pipes. Acids, alkalies, etc., have attacked both kinds of pipe and produced their effects.

On the other hand, vitrified clay pipe sewers laid in the early history of the art of making and laying them are still where they were put, and in the same good condition as when laid; concrete pipe sewers made with natural hydraulic cement have been in use for forty or more years and are still in good condition, and Portland cement concrete sewers have been in use nearly as long.

Engineers have had enough experience with both kinds of material to make specifications which will insure good material and workmanship, provided the inspection is sufficiently expert and honest to bring the material and construction up to the specifications. The principal, indeed, the only requirement, is competent, reliable, honest, strong engineers and inspectors and the undivided support of the municipal authorities in their efforts to get the results they know are possible.

The books written on the subject are

mainly unreliable because written to support one material and attack the other, so that they suppress the undesirable failures on one side and the successes on the other. The text-books on sewers, such as Folwell's "Sewerage" ($3), Ogden's "Sewer Design" ($2), and "Sewer Construction" ($3) give little on the differences between the two materials, but describe structures made with both and endorse them both. The subject has been discussed in one phase or another in several articles in MUNICIPAL ENGINEERING, among them the following:

In vol. xxxix: "Effect of Sewage and Sewage Gases on Portland Cement Concrete," p. 41.

Vol. xxxviii: "Cities Using Concrete Pipe Sewers," p. 40. "Forms for Concrete Sewers," p. 420.

In vol. xxxvii: "Experience with Concrete Sewers," p. 34; "The Destruction of Concrete by Alkali," p. 112; "Concrete Sewer Pipe for Denver, Col.," p. 203; "Articles on the Effect of Acids and Alkalies on Reinforced Concrete," p. 183; "Concrete and Brick Sewers," p. 243.

In vol. xxxi: "Limestone in Concrete for Sewers," p. 361; "Durability of Concrete Sewers," p. 108; "Natural Hydraulic Cement Sewer," p. 182; "Concrete and Vitrified Pipe for Sewers," p. 379.

In vol. xxxv: "Concrete Sewer Pipe," p. 102; "Durability of Cement and Concrete in Sewers," p. 114; "Concrete and Brick for Sewers," p. 178; "Effect of Alkali Soils and Waters on Concrete," p. 37; "Salt and Sea Water for Mixing Concrete," p. 391; "Effect of Salt and Alkali on Concrete," p. 385.

An extended list of articles is given in vol. xxxviii, p. 192.

Cities Using Calcium Hypochlorite in Water Purification.

We are considering treating our water supply with sodium or calcium hypochlorite. We pump from 400,000 to 500,000 gallons per day. This must be done in the simplest manner possible. Kindly place me in touch with parties manufacturing the equipment necessary for this installation. If no one manufactures this special machinery, kindly inform me of the names of those who have installed such treatment.

N. H. M., ———, W. Va.

Minneapolis, Minn., Boonton reservoir, Jersey City, N. J., Poughkeepsie, N. Y., McKeesport, Pa., are a few of the cities that have experimented with calcium hypochlorite in sterilizing water supplies. The same chemical has been used in treating sewage at Red Bank, N. J.; Walbrook, Pa.; Baltimore, Md.; Bubbly Creek, stock yards, Chicago, Ill. Many water works superintendents have used the process occasionally, some results being reported in recent numbers of MUNICIPAL ENGINEERING, such as vol. xxxix, p. 222, being a study for New York City conditions; vol. xxxviii, p. 313, being a report of experiments by the Baltimore (Md.) County Water and Electric Co., at Avalon, Md., with hypochlorite of calcium; vol. xxxvii, p. 383, at McKeesport, Pa.; vol. xxxvii, p. 23, at Gruenewald, Germany; pp. 6, 86, 158, at the Boonton reservoir of the Jersey City water supply; p. 365 on sewage disinfection.

Combined Electric Light and Water Plants.

What can you tell me about combined electric light and water plants? Are they many of them, and of what size are they? Are they under municipal or private ownership? SUBSCRIBER.

There are many of these combined electric light and water plants in small cities, towns and villages. They do not seem to be popular, for rather obvious reasons, in the larger cities. In MUNICIPAL ENGINEERING, vol. xxxvii, p. 257, will be found a partial list of cities owning both electric light and water plants, but they are all operated separately.

From the *McGraw Electric Directory* can be selected quite a complete list of the combined water and light plants.

Alabama has 13 municpal plants and 6 under private ownership in towns varying in population from Samson (municipal), with 300, to Dothan (municipal), with 5,275 in 1900.

Alaska has two plants, at Valdez with 315 and Ketchikan with 1,200 population, both under private ownership.

Arizona has four private plants serving populations from 350 in McCabe to 5,500 in Nogales.

Arkansas has 7 municipal and 15 private plants serving populations varying from 125 in Junction City (private) to 15,000 in Hot Springs (private).

California has 4 municipal and 18 private plants, populations varying from 300 in Butte City (private) to 5,000 in Palo Alto (municipal).

Colorado has 3 municipal and 5 private plants, populations varying from 364 in Holly (municipal) to 3,775 in Canon City (private).

Connecticut has 3 municipal and 2 private plants, populations from 1,213 in Newark (municipal) to 3,667 in Westport (private).

New Castle, Del., 3,380 population, has a private plant.

Florida has 4 municipal and 5 private plants, populations varying from 366 in Winter Park (private) to 6,509 in Lake City (municipal).

Georgia has 25 municipal and 6 private plants, population varying from 503 in Vidalia (municipal) to 9,453 in Brunswick (private).

Idaho has 5 private plants, populations served being from 200 in Meridian to 4,046 in Pocatello.

Illinois has 14 municipal and 23 private plants, populations ranging from 417 in North Chillicothe (private) to 25,506 in Bloomington (municipal).

Indiana has 24 municipal and 28 pri-

vate plants, populations ranging from 765 in Zionsville (private) to 12,300 in Shelbyville (private).

Iowa has 10 municipal and 7 private plants, populations varying from 956 in Lisbon (municipal) to 5,041 in Le Mars (private).

Kansas has 15 municipal and 5 private plants, populations varying from 800 in Kiowa (municipal) to 13,024 in Hutchinson (private).

Kentucky has 1 municipal and 11 private plants, populations varying from 654 in Pembroke (private) to 4,081 in Mayfield (private).

Louisiana has 13 municipal and 2 private plants, populations varying from 800 in Tallulah (municipal) to 15,000 in Lake Charles (private).

Maine has 1 municipal and 5 private plants, populations varying from 88 in Belgrade Lakes (private) to 4,758 in Caribou (private).

Maryland has 1 municipal and 4 private plants, populations varying from 215 at Lock Lynn Heights (private) to 3,199 in Westminster (private). Part of Baltimore and several of its suburbs are also supplied by a company.

North Attleboro, Mass., 10,500 population, has a municipal plant.

Michigan has 31 municipal and 5 private plants, ranging in population from 450 in Sillman (private) to 22,172 in Lansing (municipal).

Minnesota has 38 municipal and 3 private plants, populations ranging from 350 in Belgrade (municipal) to 9,574 in St. Cloud (private).

Mississippi has 23 municipal and 3 private plants, populations ranging from 263 at Belzona (municipal) to 4,944 at Yazoo City (municipal).

Missouri has 19 municipal and 12 private plants, populations ranging from 632 in Forest City (municipal) to 45,000 in Joplin (private).

Montana has one municipal and 5 private plants, populations ranging from 90 in Gardiner (private) to 10,000 in Missoula (private).

Nebraska has 8 municipal and 2 private plants, populations ranging from 850 in Randolph (municipal) to 7,380 in Nebraska City (private).

Nevada has 6 private plants with populations ranging from 150 in Fallon to 15,000 in Reno.

New Hampshire has a municipal plant at Littleton, population 3,702, and a private plant at Warren, population 791.

New Jersey has 8 private plants, population ranging from 70 in Deal to 6,845 in Summit.

New Mexico has private plants at Santa Fe population 8,000, and Tucumcari, population 800.

New York has 5 municipal and 3 private plants, populations ranging from 1,231 in Cape Vincent (private) to 35,743 in Elmira (private).

North Carolina has 9 municipal and 1 private plant, populations ranging from 1,072 in Dunn to 4,610 in Gastonia, both municipal.

North Dakota has 5 private plants serving populations ranging from 1,125 in Williston to 4,059 in Valley City.

Ohio has 29 municipal and 12 private plants, populations varying from 626 at Mt. Pleasant (private) to 21,000 at Norwood (municipal).

Oklahoma has 12 municipal and 3 private plants, populations varying from 450 at Fairview (municipal) to 3,800 at Stillwater (municipal).

Oregon has 3 municipal and 13 private plants, populations ranging from 127 at Vale (private) to 5,000 at Medford (private).

Pennsylvania has 1 municipal and 6 private plants, populations ranging from 250 at Colemanville (private) to 10,832 at Carlisle (private).

Wickford, R. I., population 1,500, has a private plant.

South Carolina has 6 municipal and 8 private plants, populations ranging from 449 in Pickens (private) to 8,000 at Rock Hill (private).

South Dakota has 2 municipal and 1 private plant, populations ranging from 391 at Wilmot (municipal) to 3,265 at Brookings (municipal).

Tennessee has 16 municipal and 5 private plants, populations ranging from 210 in Millington to 17,193 in Jackson.

Texas has 3 municipal and 36 private plants, populations ranging from 635 in Marble Falls (private) to 22,258 in Austin (municipal).

Elgin, Utah, population 150, has a private plant.

Morrisville, Vt., population 1,087, has a municipal plant.

Virginia has 1 municipal and 6 private plants, populations ranging from 1,220 in Shenandoah (municipal) to 5,300 in Clifton Forge (private).

Washington has 11 private plants, populations served ranging from 254 in Pasco to 6,976 in North Yakima.

West Virginia has 9 private plants, populations served ranging from 442 in Welch to 23,000 in Charleston.

Wisconsin has 16 municipal and 10 private plants, populations ranging from 612 in Bruce (municipal) to 37,643 in Superior (private).

It should be noted that only four cities in the list, Bloomington, Ill., Elmira, N. Y., Superior, Wis., and Joplin, Mo., have more than 25,000 population; there are 24 cities of 10,000 to 25,000 population; there are 49 cities of 5,000 to 10,000 population; there are 618 cities and towns of less than 5,000 population; making a total in the list of 695 cities and towns. In other words, 89 per cent. of the cities and towns having combined electric light and water plants have populations less than 5,000.

As to ownership, 364 are under muni-

cipal ownership and 331 under private ownership, a practical equality. There are great differences in the proportions of the two classes of ownership in the various states, however. Thus, there are 11 states which have no municipally owned plants, all being among the newest western states except Delaware, New Jersey and West Virginia. Vermont and Massachusetts have each but one plant and that municipally owned.

Alabama, Georgia, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Nebraska, North Carolina, Ohio, Oklahoma, Tennessee, Wisconsin, have a large preponderance of municipally owned plants, while Arkansas, California, Illinois, Kentucky, Oregon, Pennsylvania and Texas have a preponderance of privately owned plants, in addition to the states named above having only such plants.

The geographical distribution of these groups of states is of interest, especially when taken in consideration with the dates at which development of improvements in small cities began in the respective states.

Information About Gas Manufacture.

We are referred to you by Mr. J. M. Lloyd, Associate Editor of the *Iron Age*, for information about the installation, manufacture and operation of plants for producing gas for heating and lighting of a capacity to supply a population of 25,000 to 50,000.

What is the approximate cost of a plant and the street mains for an area both two and three miles square with glacial soil conditions?

What is the best process at this date for producing the richest gas for the purposes named, and to produce it save all by-products? What are the principal by-products that are worth saving, and what is the value of each at the plant in this vicinity? Is there a ready market for these by-products? Does your answer to the first question cover the cost of a plant as indicated in this paragraph? If not, make it do so.

What is the Solvay Process, and is gas a principal or by-product by it? Is the gas by it of first quality for the purposes named?

What are the gas values and by-product values both in quantity and items and in dollars and cents of a ton of coal of the leading gas and coke producing varieties of coal? R., ———, Ind.

It is impossible to give satisfactory answers to these questions even in a general way. To answer them specifically would require full knowledge of the local conditions, including the relative importance of first cost and cost of production, an item which would demand full consideration of the financial questions involved. This would require the services of a consulting engineer with experience in these matters. The following general information may be given, mainly to show the difficulties in the way of such treatment of the subject, and to give some idea of the problems to be met.

There are great variations in cost of plants and some variation in cost of systems of distributing mains. Methods of fiancing a proposition will also have much influence on the cost of a plant. The range of areas and possible populations and uses of gas in the question is very large. Plants with capacities within the given limits have been constructed at costs varying between $200,000 and $1,200,000. The kind of plant chosen is another factor accounting for the large differences between maximum and minimum cost.

Probably the coal gas process would be considered by unprejudiced observers to be the best under ordinary conditions. The principal by-products of the coal-gas process are coke, which sells for, say $4 to $6 a ton, according to the relation of the local demand to the supply furnished by the gas works; tar, which sells for, say 2¼ to 2½ cents a gallon, 8 to 10 gallons being obtained per ton of coal carbonized; and ammoniacal liquor at, say 1 to 2 cents a pound, according to strength, or say 20 cents a ton of coal carbonized.

If there is a market for the first class coke produced in a coke oven plant, such as the Otto, that process is still more economical than the coal-gas process. Assuming a market for the coke at its proper price, as compared with coal for the same high-grade uses, the gas is a by-product, as well as the tar and ammonia, and the money received from the sale of the gas is practically all profit.

The water-gas process requires less expenditure for plant, but there are practically no residuals and so the cost of gas has no credits to offset. The cost of making gas depends on the cost of oil and fuel. Many plants use combinations of coal and water gas, because the market for gas-house coke is likely to be slow and it can be used in a water-gas plant to advantage. There are, therefore, few pure coal-gas plants. Water-gas plants are economical in small cities and towns where the daily consumption is not sufficient to keep the smallest practicable plant running all the time, for the expense of stopping and starting the plant is much less than for the other processes.

Assuming a coke-oven plant to cost $1,200,000, a coal-gas plant will cost, say $900,000 for the same capacity, and a water-gas plant say $800,000. Such a plant might serve the larger area in one city and might be required for the smaller area in a city where there was large demand for gas. It is quite possible that for the smaller area named and for a rather sparse population or few consumers, a plant could be constructed for the minimum figure quoted, giving no chance for expansion without addition to plant. All of these figures must be in the nature of guesses until full and definite information regarding the local conditions is obtained.

The Solvay process is a process of making coke, similar to the Otto process, and gas is a by-product. Part of the gas produced is of high quality, and if only this

part is saved for use of consumers of gas the service will be satisfactory. The poorer portion of the gas is used in heating the coke ovens, under the boilers in the plant, etc.

The best sources of information regarding the gas and by-product values of coals are the recent reports of investigations of coal by the Geological Survey and other U. S. Government departments. They can now be obtained of the newly established Bureau of Mines, Department of the Interior, at Washington, D. C.

Books on Portland Cement Manufacture.

Will you please state the name of some reliable work giving all necessary instructions for manufacturing Portland cement and estimates of cost, tests as to suitable raw material, etc.

C. M., Selma, Ala.

Eckel's "Cements, Limes and Plasters" ($6) is the most complete book on the manufacture of these materials. There is also a book on "The Cement Industry" ($3) which is now somewhat out of date, but gives descriptions of a number of plants in this country and abroad. H. S. Spackman has a book on "Cement Manufacture" devoted mainly to descriptions of the machinery used.

How to Find Leaks in Water Mains.

As you have a question department I would like to know if you can give me any information which will assist us to locate leaks. We are pumping a great deal more water than should be used and we feel sure a great deal of it is wasted as the water in our elevated tank disappears so rapidly at night when there is very little being used.

We presume that some of this is caused by people letting the water run in summer time to keep it cool and in winter to keep pipes from freezing, and also that some is lost through neglect to repair automatic pumps and valves; consequently we are now having an ordinance prepared requiring the water takers to install meters.

However, we do not believe that this accounts for all of the waste and we are at a loss to know how to locate any leaks in the mains. We know that ordinarily, where there is a leak in the main, water will come to the top of the ground, but here there is tile laid on nearly every street where there is a main and oftentimes the two strings are less than a foot apart, so it seems to us that the water might go from the leak in the main to the tile and never show on the top of the ground.

If you can give us any information which will assist us in determining whether there are such leaks and if so where to locate them we will be under many obligations to you, for we are pumping a good many more hours than we think should be necessary.

S. A. F., Mayor, ———, Ill.

This is one of the most vexatious problems with which the water works manager has to deal. It is comparatively easy to find house connections through which waste is taking place, by a house to house inspection and by a water phone, or even a common key for turning off the water, the sound of the running water being transmitted through the rod to the ear held against it. This inspection being made at night when all water is supposed to be turned off in the houses will give the basis for house inspection and location of leaks.

Leaks in street mains are harder to find. A complete system of valves whereby the system of pipes can be divided into small districts will aid most materially in the search.

The Deacon and Rodda water waste detectors, for house connections, and the use of meters in determining waste from districts are briefly described in MUNICIPAL ENGINEERING, vol. xvi, p 242. The report of the water works department of Columbus, O., for 1902, gives the method of making a leak survey for the city. A test for leaks in a pipe laid under a river is described in vol. xxviii, p. 384. The results of the use of the pitometer in making a leakage survey in Spokane are given in vol. xxviii, p. 477. This method is probably too expensive for application to a small system. A very full detailed description of "How to Find Leakage in Water Mains and Services," by a water works superintendent will be found in vol. xxxvi, p. 319. Two brief articles giving some suggestions are on p. 108 of the same volume. A description of the use of the pitometer in measuring water waste is given in vol. xxxvii, p. 257. A full description of the aquaphones or waterphones for detecting flow of water through valves or connections is given in vol. xxxvii, p. 329.

Books and Patents on the Septic Tank.

Kindly advise me of a good book on septic tank construction, in the simple form. Also I wish to avoid conflicts with patent rights and I would thank you for any information as to who, if any one, controls the right to use the simple septic tank.

I am figuring on a sewer system and would be grateful to you for this information. Yours truly.

R. L., ———, Cal.

See the article in this department under the heading, "Books on Sewage Disposal," for answer to the first part of the question.

As regards the septic tank patents full information can be obtained by consulting the following articles in MUNICIPAL ENGINEERING on this and related subjects:

In vol. xxxix: "Cameron Septic Tank Patents," p. 238; and the article on "The Present Use of the Septic Tank," elsewhere in this number.

In vol. xxxviii: "New British Sewage Disposal Works," p. 177; "Information About Cameron Patents on Sewage Purification Processes," p. 192, giving descriptive references to a number of valuable preceding articles.

Books on Estimating.

Please let me know the title, price and place of sale of some of the most up-to-date books on contractors' estimates, covering concrete work, sewers, excavations, pipe laying, railway construction, paving, etc., giving unit costs.

P. M., Edmonton, Alberta.

Gillette's "Handbook of Cost Data" ($5) has some 1850 pages of information, more or less thorough and reliable, on this subject. The book can be used successfully by an experienced contractor or engineer if due care is used in applying the information to local conditions. This is, of course, true of any book of this nature. Arthur's "New Building Estimator" ($2.50) is a small book covering building construction and giving some data on the lines of work mentioned.

Books on Sewage Disposal.

Please give me a list of books on sewage disposal. R. R., Quebec, Ont.

Good lists of books and articles on sewage disposal will be found in MUNICIPAL ENGINEERING, vol. xxxiii, p 175; vol. xxxviii, p. 346, and vol. xxxix, p. 291.

To the list of articles there given may be added the following in vol. xxxix: Sewage Purification by Irrigation," p. 38." "Covers for Septic Tanks," p. 39; "Effect of Sewage and Sewage Gases on Portland Cement Concrete," p 41; "Use of Sewage for Irrigation at Fresno, Cal."

Free Delivery of Express Packages and Telegrams.

The City of Atlanta is interested in securing free deliveries of packages or messages by express and telegraph companies. Your journal devotes much attention to municipal matters and it occurred to me that you might be able to refer to publications treating on this subject. J. L. M., Atlanta, Ga.

This is a question which has given considerable trouble in a number of cities. The question is readily settled if the original franchise to the telegraph company required free delivery within the city limits. If not so settled, as regards telegrams, and in any event as regards express packages, the free delivery may perhaps be secured through ordinances passed by the city council. The two classes of deliveries are on somewhat different basis, since the telegraph company occupies the streets with its poles and conduits and so comes under the control of the city authorities to a certain extent, while the express company can only be reached through ordinances taxing the business or the vehicles by means of which it is carried on. Even if the free delivery ordinance is beyond the power of the city council to pass, the same result may be obtained through the introduction of ordinances on the lines above suggested.

The ordinance in the City of Indianapolis, Ind., concerning telegrams, provides:

That it shall be unlawful for any telegraph company having in its possession a telegram or message for any one within the corporate limits of the city of Indianapolis, Indiana, to make a charge for the delivery of the same, except such charges as are necessary to pay for the transmission of the same to the office of the company within the corporate limits of the city of Indianapolis, Indiana.

Any one violating any of the provisions of this ordinance shall, upon conviction be fined for each offense in the sum of not less than $5, nor more than $50.

The only ordinance governing express companies is one assessing a vehicle tax of $12 a year for each wagon used in delivering express matter, and $1 a month for each new wagon put on during the year, from the date of beginning work.

Vacuum Street Cleaning Machines.

We should very much indeed like to know whether your publication has recently printed anything regarding the use of vacuum street cleaning machines, either in Europe or the United States, and if you know of any such devices recently patented in the United States, and what you think of their probable value. F. B., New York City.

Reference may be made to the August number of MUNICIPAL ENGINEERING, vol. xxxix, p. 115, for a statement of the recent patents on vacuum street cleaning. The Furnas machine long since demonstarted its success. Their new automobile machine was damaged by fire at the factory just as it was ready for trial, and is not yet repaired, but is promised shortly. The others are in the experimental stage.

Rock Island's Brightways.

Practically all the business houses on Second avenue, in Rock Island, Ill., have signed a contract for the installation of the cluster light system. Mayor G. W. McCaskrin has stated that he will endeavor to secure the approval of the council to the plan of using the lights on the four sides of Spencer square, and the People's Power Company is lending encouragement to the enterprise by announcing that a specially low rate for electricity will be made.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

The Time to Kill Willows.

To the Editor of MUNICIPAL ENGINEERING:

Sir—In answer to the query of O. O. L., as to how to kill willows, I will say that there is only one day in the year when this can be done by the usual method of girdling. This is in August when the sign is in the heart. This is the testimony of a steamboat captain whom I heard discussing the question.

W. B. EELLS, Mount Gilead, O.

Unfortunately, this is quite too indefinite a statement regarding the one day, for there are twenty-two days in August when the sun is in the sign of the heart (Leo). This is an excellent example of the misapplication of an original rule which, perhaps, had some foundation in observations of facts, due to the ignorance and bad memory of the transmitters of the rule, and which thus becomes a superstition, pure and simple. Can any one give further information regarding this or any other method of stopping the growth of willows?

Relative Action of Calcium Chloride and Oil on Stone and Gravel Roads.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The first essential factor of life and service in a stone or gravel road is a bond of moisture. Oil and water will not mix and stay mixed, even with a soap emulsion. The principal characteristic of calcium chloride is to gather and give out moisture, insuring a perfect moisture bond. It is, as stated in my article published in your September issue, a chemical sponge with a tendency to attach itself to any substance which does not have a greasy, oily property in it. This tendency bars it from successful use on roads that have been oiled, except in the filling of ruts where a prepared road material may be lodged and confined in considerable quantity. It is possible through this filling of rutty places, which develop very rapidly in oil-treated roads, to finally put on a new surface and so again recover the roadway.

Calcium chloride is the greatest known absorbent and retainer of moisture, with the possible exception of the sponge, and so must be a life-prolonging factor, when employed in and on a stone or gravel roadway. But to secure the best results, an artificial supply of water must be given it when rain, dew,, frost or damp air do not give a required quantity. These, however, supply so large a part of its need, that artificial watering is in no sense a burden or hardship nor an expense that will in any way measure up to the life-giving and sanitary conditions realized through a proper treatment and care of roadways.

As stated above, oil and water will not mix, and so an oil treatment must be made with the road surface as nearly dry as it is possible to get it. In excessively and long-continued dry weather with oil having a full portion of gum in its composition, it is possible to get a longer first hold down on the dust than with calcium chloride if used without artificial wetting. But as soon as the gummy properties of the oil are absorbed by the road material, as it will be in a few weeks or months, according to the quantity of heavy substance in the oil and to the traffic over the road, disintegration begins and develops rapidly, with a call for more and more oil to an ultimate point of a prohibitive cost. This, I believe, has been the experience of all who have tried oil to a final conclusion.

Again, the first cost of the oil treatment depends wholly on the quantity of heavy asphaltum body in the oil, and on this also depends its first life or action as a road binder and dust layer, and so the cost is measured entirely by this heavy substance, as is the service after treatment. I have never made any direct oil applications, and so cannot give relative costs except by citing the government report on oiled roads, which gives the cost as varying from three to fifteen cents per square yard. That report says that oil with a paraffin base is of little value as a dust layer or road binder, and that the cheaper estimates of cost are based on these light-body oils. The calcium chloride treatment costs from two to five cents per square yard, the excessive cost being principally in preparing the road and working the chemical into it.

Next, as to the staying or lasting qualities of the two treatments. As soon as an oil-treated road is subjected to a heavy

flow of water through a hard shower or long rain, a large part of the oil is washed into the gutters or sewers and with it go all loose, oily particles which will float on the surface. This is shown by the rapid accumulations of these particles in the gutters or road depressions. This loose dirt is soon ground into flying dust, but in this case your dust is greasy and smirches everything it touches. If calcium chloride is kept properly supplied with moisture, no dust will fly beyond the gutter line, and the moment the road surface is wet, any loose particles on it are immediately held in bondage. You will find very little loose material in the gutters of a chemically treated roadway, and, as nothing blows off the road surface, very little disintegration takes place.

Again, an oil-treated roadway when freshly treated is a very dirty and foul-cmelling thoroughfare. It is also slippery and dangerous for horse traffic, and very dirty and dangerous for auto traffic and distructive to rubber tires. If, on the other hand, proper drainage for the excess falls of water is provided, you never have a muddy or slippery road in a chemically treated roadway, nor one that will develop ruts or wheel marks to any great extent. Where they do develop from a compression of excessively heavy traffic and the heavier the traffic is on these (roads the better, as it means a thorough compacting) or the settlement of the base, these places are quickly filled with the mixed road compound, which may be mixed and kept indefinitely, ready for use in such cases. The traffic over these places, filled and tamped slightly to insure an even filling, will iron them down and give a surface as smooth as a sheet asphalt roadway, without any of the slippery, dusty and objectionable features of that roadway.

For horse traffic it is the ideal roadway, as it has enough elasticity in it to prevent the shock or jar of the harder pavements, and, on account of its packing properties, even as soft filling material as ashes and cinders, may be used. In the latter case, about 33 per cent. of coarse bank sand should be used in the body mixture. Through the lasting qualities of calcium chloride, large parts of each application are retained on the road top from year to year, calling for lighter applications each year with the possibility of skipping several years at frequent intervals. In other words, an oil-treated roadway grows rapidly worse with a relatively large increase in cost of maintenance, while with the chemically-treated roadway it is rapidly improving at a decreasing cost almost to the vanishing point.

S. G. Howe, Detroit, Mich.

Flushing Streets Under High Pressure.

To the Editor of Municipal Engineering:

Sir—In your October issue I read with interest the article written by J. W. Howard, New York City, under the heading of "Flushing Pavements with Water Under High Pressure," in which he quotes from an article written by me some time previous regarding the causes of defects in asphalt pavements which are entirely under the control of the municipal engineer.

The writer had two particular cities in mind when that original article was written. One was St. Louis, Mo., which Mr. Howard refers to in his article, and where the flushing is done by high pressure machines or wagons, and the other was Minneapolis, Minn. In this latter city the asphalt streets are sprinkled during the day by the old-style sprinkling wagons and are flushed every night with a stream of water from a three-inch fire hose under the full pressure of the water mains. Every slight hole or depression in the paving naturally collects dirt and required the full force of the water for several seconds to dislodge same. A stream of water capable of tearing through walls and partitions of burning buildings would surely seriously injure any thoroughfare when directed nightly on spots which were, perhaps, already showing signs of wear.

The Grand Canon of Arizona is caused by the running waters of the Colorado river gradually wearing away the mountainous rocks, so it is not surprising that many of our modern thoroughfares are seriously injured by the high-pressure flushing system of street cleaning adopted by the officials of many of our cities.

Isaac Van Trump,
Asphalt Chemist, Chicago, Ill.

..Vitrified Brick at the International Road.. Congress.

To the Editor of Municipal Engineering:

Sir: On page 276 of your October issue, Prof. E. D. Rich, of Ann Arbor, Mich., expresses surprise and regret that the second International Roads Congress at Brussels, apparently gave no consideration to vitrified brick pavements.

The subjects for consideration at these Congresses are selected by the Permanent Commission of the International Association of Road Congresses. The United States of America is not represented at present on this Commission, and in no other country that is represented, is the use of brick paving important enough, apparently, to have prompted its selection for consideration at the Congresses.

The writer regrets the facts, and remembers some discussion at Brussels among the American delegates concerning them, but these delegates seemed powerless to do anything in the matter.

The writer agrees with many of the remarks of Prof. Rich, and begs to suggest that two courses lie open:

First—To secure representation of the United States on the Permanent Interna-

tional Commission, and, through such representation, to secure consideration of the subject in future Congresses; or

Second—To secure the consideration, by the addressing of a communication from those interested, to the Permanent Commission of the International Association of Roads Congresses.

The writer hopes one or the other—preferably the first course suggested—may be successful.

W. W. CROSBY,
Chief Engineer, State Roads Commission.
Baltimore, Md.

Repairing a Catchbasin.

A great deal of trouble has been encountered in the process of installing heating pipes through the downtown section of Indianapolis. The great numbers of water, sewer, telephone and other underground installations have made the matter of finding space for the new heat conduits a problem not easy of solution:

In addition to this trouble the soil is of a sandy gravel which flows so easily as to require sheathing on all the work. The trenches are of an average depth of 8 or 10 ft. and are sheathed with 2-inch planks braced with 4 by 4 inch blocks and the ordinary form of jack used on such work.

Recently during an excessively heavy rain an accident occurred which required rather unusual means of remedy. A trench had been constructed along one street and in turning at right angles to proceed down another street, a catch basin wall was made use of in the place of sheathing at one side of the trench. Owing to the suddenness and intensity of the rain, the catch basin was almost filled with water, and the extra pressure caused the failure of a weak spot in the wall, allowing the water to pour into the trench.

The break was exceedingly difficult to reach owing to the obstruction of the sheathing braces. Blocks of wood, boards, etc., were tried in an effort to stop the flow and prevent a complete flooding of the trench, but the head of about 6 ft. on the opening prevented such a remedy. The flow was finally stopped by using several bricks laid in place and held by a 2-inch board which in turn was backed by a block and jack set against the opposite wall of sheathing. The chinks between the brick were stopped with rags and such emergency packing as was available.

In the final repairs it was necessary to use rather novel means, as the opening was below the ordinary level of the water in the catch basin. A large half tile, used in the construction of the heat conduit to enclose the heat pipes and form an insulation, was set down inside the catch basin so as to enclose the opening. This was held tightly in place and the joints between the tile and the wall were made as tight as possible. The temporary stop was then removed and the opening bricked up from the outside.

MUNICIPAL MATTERS IN COURT

Decisions of the Higher Courts of Interest to Municipalities.

Municipal Corporations—Dissolution.—Where a municipal corporation has once been organized, it does not become dissolved by a mere failure to elect officers, or by a failure of such officers elected to perform corporate functions, but, for the purpose of being sued for corporate debts, continues to exist per se.—United States Bank v. City of Kendall (Kan.), 179 F. 914.

Highways — Establishment. — A road may become a public road by prescription. Evidence that the public had used the road continuously for 20 years, and that the proper county authorities during that time have recognized it as a public road by having the same worked, will be sufficient to authorize an inference that such road is a public road. In determining whether a road used by the public for the period of 20 years has been accepted by the authorities of the county, evidence that a public road overseer had caused it to be worked, and that, after complaint of a citizen to the ordinary of the county to take charge of the road, it had been worked by the road hands, is relevant and admissible.—Louisville & N. C. H. Co. et al v. Hames (Ga.), 68 E. 80. 5

Rural Ways—Defects.—A municipality is not required to exercise the same care in grading and constructing a rural way as when improving a street in the populous portions of the city. In improving and maintaining such roadways the city is not required to grade or improve to the entire width of the highway.—Neidhart v. City of Minneapolis (Min.), 127 N. W. 484.

Powers—Acquisition of Public Utilities. —The state may empower municipalities

to acquire and operate any such necessary public utility as is generally owned and operated in a city by public service corporations, such as waterworks, gas or electric light plants, street railways, etc. A municipality can acquire a street railway only under express authority from the state. Municipalities can exercise only such powers as are expressly or by necessary implication conferred upon them.—Platt v. City and County of San Francisco et al (Cal.) 110 P. 304.

Suits for Injuries—Notice of Claim—Subsequently Developing Injury.—Under a provision of Spokane charter requiring claims for personal injuiries caused by defects in streets, etc., to be presented within one month after the accident, a claim does not preclude recovery for injuries not specified therein where they developed after the time for filing the claim.—Pierce v. City of Spokane (Wash.), 110 P. 537.

Nuisance—Remedy by Injunction.—The erection and maintenance of a wagon yard in a city for the shelter of farmers' and peddlers' wagons loaded with farm produce is not a nuisance per se, and equity will not enjoin its erection.—Cooper v. Whissen et al. (Ark), 130 S. W. 703.

Water Rents—Leases to Private Individuals.—A village leasing its waterworks to individuals may protect its inhabitants from excessive charges for water supplied by the individuals and as a part of the consideration for the lease the individuals may agree with the village to supply water free of charge to engine houses, schoolhouses, etc.—St. Patricks Church Society of Corning v. Heermans (N. Y.), 124 N. Y. S. 705.

Torts—Liability.—A city when acting in its private capacity as distinguished from its public functions is liable the same as a private corporation or individual for wrongful acts of its agents and employes while acting within the apparent scope of their authority.—Provine v. City of Seattle et al. (Wash.), 110 P. 619.

Grading Streets—Liability of City.—To hold a city for injury caused by street grading contractors in placing an extra fill on an adjoining lot, plaintiff need not show that the city expressly directed the contractors to make the extra fill; it being sufficient to show that the work was the ctiy's undertaking, and that in its course his injury was inflicted by persons in charge, in the absence of a showing by the city that the contractors were independent contractors.—Provine v. City of Seattle et al. (Wash.), 110 P. 619.

Federal Courts—Jurisdiction—Federal Question.—A muncipal ordinance legislative in character, in the exercise of delegated authority to make laws which the Legislature might have made, has the force of a state law within the contract clause of the Constitution, and, where such ordinance impairs the obligation of a prior contract made by the city, a suit to enjoin its enforcement involves a question arising under the Constitution of the United States, of which the federal courts have jurisdiction, where the requisite amount is involved, without regard to the citizenship of the parties. —Nelson v. City of Murfreesboro et al. (Tenn.), 179 F. 905.

Municipal Corporations — Powers — Lighting Contracts.—Murfreesboro city charter gives the city council authority to license, tax and regulate all business and corporations lawful to be carried on within the city. Subsection 11 gives the city complete control over the city streets, and subsection 13 gives power to provide for the erection of lamp posts, lamps, electric fixtures, and lamps for the lighting thereof, for strictly municipal purposes. Section 12 provides that no order or ordinance shall be made involving the expenditure of money or the contraction of a debt against the corporation unless money sha l be [illegible] the city treasury to pay such debt or expenditure, or the same shall be within the amount of the current year's taxes for such purposes. Section 12 was amended by Laws 1905, c, 41, declaring that the provisions of section 12 should not apply to contracts made by the city council for the furnishing of lights for the city streets, and that the council should have power to make all necessary and proper contracts with any individual or corporation for the lighting of the streets for any period not longer than 10 years, and to make appropriations annually for such purposes. *Held*, that the amendment was not intended to enlarge the power of the city council so as to permit it to give a franchise generally in the ctiy streets in reference to any matter distinct from that of street lighting, but that its primary purpose was to do away with the original limitation upon the council's power so as to permit it to make such contracts for 10 years and appropriate money therefor, and the section does not confer the power to incorporate in such contract, under the guise of an additional consideration to the contractor, an exclusive franchise permitting the furnishing of electricity to the inhabitants of the city for lighting, heating, and power during the term of the contract.—Nelson v. City of Murfreesboro et al. (Tenn.), 179 F. 905.

Implied Powers—Exclusive Privileges in Streets.—A municipal corporation has no general implied power to grant exclusive privileges in the streets, such power not existing unless given by the Legislature in express language or necessarily implied from other powers, and, if inferred from other powers, it is not enough that the authority be convenient to them, but it must be indispensable.—Nelson v. City of Murfreesboro et al. (Tenn.), 179 F. 905.

WATER AND LIGHT

Detroit Water Supply—Chattanooga Water—Concrete Water Towers—Slot Machine Lights—Chicago Lights

Attack on Detroit's Water Supply.

A special commission appointed by the American Medical Association has stated that the excess of typhoid in Detroit is probably due to an impure water supply. The report states the case in part as follows:

Conners creek flows through a large cemetery and receives the drainage from a part of Fairview. The situation thus created seems to have been a cause of anxiety to some of the Detroit authorities for a long period. In the discussion of the 1892 epidemic it is stated that as a rule the water of Conners creek does not mix sufficiently with the main current of the river to reach the intakes, but flows past nearer shore. Even if this is the case, however, there is certainly danger from this source when an intake pipe nearer shore is used, as seems sometimes to be the case. There is some evidence, furthermore, that the water at the main intake crib may be affected. One observer is on record as follows: "When there is a flood in Conners creek basin the foul waters of the creek can be readily seen all the way from its mouth in the river to the opening of the city sewers. It is not unusual after heavy rainfalls and consequent floods of the creek basin to find the city water as drawn from the house faucets contaminated with quantities of organic matter."

A recent visit to Conners creek shows that the stream at the present time is heavily laden with sewage. A hundred yards south of Jefferson avenue, near the large manufacturing establishment of the Chalmers Motor Company, the conditions are substantially those of an open sewer. Grease and paper float on the surface and the bubbles of gas which are rising to the surface testify to the active decomposition of organic matter taking place on the bed of the stream. The current is in most places exceedingly sluggish, but rapid flushing out may occur after heavy rains. An examination of the water at its mouth was made, and showed, respectively, 12 and 14 organisms of the bacillus coli group in each of two o. 1 c.c. samples.

The recent growth of population in the vicinity of Conners creek naturally increases the danger of specific infection entering the water. The gravity of the situation has been clearly recognized by the present health officer of Detroit, Dr. Guy L. Kiefer. In the 1906-7 report the statement occurs that Detroit is "reaching a death rate which will soon cast suspicion on our water supply." In the same report an appropriation is urged sufficient to carry the sewage of Fairview to a point in the river beyond the intake of Detroit's water supply.

1. The general typhoid death rate for the city is higher than would reasonably be expected in a city situated as is Detroit, but with a pure water supply.

2. The typhoid rate in the city has risen in recent years, corresponding with the growth of population in the environs of the city, and the consequent increased pollution entering directly above the water intake. This increase in typhoid fever has occurred during a period when the disease has been decreasing in the country at large.

3. The deaths from typhoid fever tabulated by months show not only the general autumnal increase, but also season irregularities that indicate water-borne infection.

4. The annual death rates show marked fluctuations, far greater than would be expected in a city of this size if the water supply were not exposed to irregular pollution.

5. One extensive epidemic of typhoid fever in Detroit (1892) has been definitely traced to the public water supply. The source of supply is now no better protected against occasional contamination than it was eighteen years ago; as a matter of fact, the danger from near-by infection (Conners creek) is considerably greater.

6. The character of the watershed, with its considerable population draining into Lake St. Clair, the fact that large boats sometimes pass close to the intake crib, the existence of a small stream that discharges raw sewage a few hundred yards from the intake, demonstrate the possibility of occasional water infection.

Health Commissioner Kiefer denies the general statements of this report, and attributes the typhoid to the milk supply rather than to polluted water.

Chattanooga Water Works Report.

Mr. Walter G. Kirkpatrick, who was retained by the city of Chattanooga, Tenn., has recently offered a report covering the cost of a system to supply a quantity of water one-half greater than the present plant. The proposed system is to be municipally owned and a bond issue of $900,000 is at the disposal of the city for that purpose. The design of Mr. Kirkpatrick will require $1,552,220, and is based on a system consisting of a river intake about eight miles up the river, with duplicate mains, except that leading to the intake, and with an emergency intake near the city, to provide against trouble in the case of a break. The estimate of cost is given briefly, as follows:

Contract A B, pumping and electrical machinery	$152,835
Contract C, boilers.....	11,928
Contract D, traveling cranes, main pumping station and intake pumping station.....	5,600
Contract E, freight elevator, head house	3,000
Contract F, tanks and standpipe for high level service..	9,115
Contract G, cast iron pipe: Distribution system, 127.3 miles mains..$379,230	

Raw water conduit..	55,570	
In buildings and grounds	23,491	
		468,291
Contract H, fire hydrants		27,800
Contract I, valves, distribution system.	11,332	
In reservoirs, buildings and grounds...	14,245	
		25,577
Contract J, sluice gates		18,964
Contract K, iron castings		170
Contract L. Concrete con. and gen. installation:		
In main pumping station	17,676	
At intake pumping station	22,790	
In filter and filter building	11,268	
In head house.....	13,698	
In coagulating and settling basins	54,842	
In storage reservoir...	90,680	
In clear water basin..	13,148	
In wash water tank and pavilion ..'....	1,982	
In grounds at purification plant	12,296	
At sub-stations	10,800	
		249,180
Contract M. Building, superstructures:		
Main pumping station.	27,300	
Intake pumping station	6,610	
Filter building	12,879	
Head house	6,495	
Gate house	300	
Pavilion and wash water tank	988	
Lookout Mountain substation	2,250	
Hill City, Missionary Ridge and Cameron Hill sub-stations ...	3,750	
		60,572
Contract N. Chimney.		8,000
Contract O. Special filtration apparatus...		33,260
Contract P. Steam and exhaust pipe system		7,700
Contract Q. Electric Transmission Lines Intake	14,819	
Sub-stations	15,637	
		30.456
Contract R. Electric wiring and lighting		3,500
Contract S. Laying water pipe:		
Distribution system ..	271,682	
Raw water conduit ..	89,590	
		361,272
Land and right-of-way		45,000
Total		$1,522,220

The present waterworks is owned by the City Water Co. and its purchase at a cost of $1,750,000 has been under consideration for over a year. In comparing the proposed plant with the one now in use Mr. Kirkpatrick stated that he had provided for more mains and larger. He places 1,357 fire hydrants against only 284 in use at the present time. These two facts will result in a greater degree of safety from fire loss and bring about a decrease in insurance rates.

The pumping engines of the City Water Co. have a capacity of 23,000 gallons, while the new plant will exceed this by 7,000. The clear water reservoir now in use has a capacity of 1,250,000 against one of 38,500,000 for the proposed plant.

In view of the difference between the estimated cost of the new system and the money available for its construction Mr. Kirkpatrick has been asked to modify his estimate, cutting out all the items that can be eliminated and basing his computation on a future population of one and one-half times instead of twice the present population of Chattanooga, as in the recent report. The new estimate will be within the $900,000 limit if it can be made so without radical changes in the main principles of the design.

Artistic Concrete Water Towers and Chimneys.

BY H. PRIME KIEFFER, C. E., NEW YORK.

This article deals with a distinctly new type of chimneys and water towers which has met with great favor abroad and is now being introduced into this country. The distinctive feature of this new system is that concrete blocks are employed throughout. By their aid the water towers and chimneys present a much more pleasing appearance than the wooden or steel towers or the brick chimneys.

In the United States there have been in use some twenty different systems in which armored concrete is employed, but they all have some primary form of scaffolding in their design and construction.

The new method of construction of which this article is a description is the invention of, and is controlled by, the contracting firm of Leon Monnoyer et Fils of Brussels, Belgium, which company also own and control all the patents issued in the principal countries of the world. The Rapid Chimney Construction Company of Room 1682, 50 Church Street, New York, are the American representatives of this system. The constructions are interesting because of their simplicity, their beauty of form, because of their economy in cost and adaptability to rapid construction.

The chimneys built under this system are composed of three parts, the foundation, the base and the shaft. The shaft is formed of reinforced concrete blocks of a peculiar and special design.

The number of blocks in each course always remains the same, yet there is a taper to the chimney. They are placed in regular horizontal courses to the required height and upon the top is placed a special capping block of either concrete, cast iron or cut stone. The workmen work on a rough platform and from the interior of the structure and each block is received by them ready for its particular position. Two men are usually employed above in laying and two below to hoist them to the platform. The blocks are lifted up the interior by an ordinary block and tackle hoist. The blocks in each succeeding course are placed in the opposite direction. That is

to say, all the even courses will have the same direction and all the odd courses will take the reverse of this. In this manner, the joining of the blocks of one course, where they do not meet perfect-

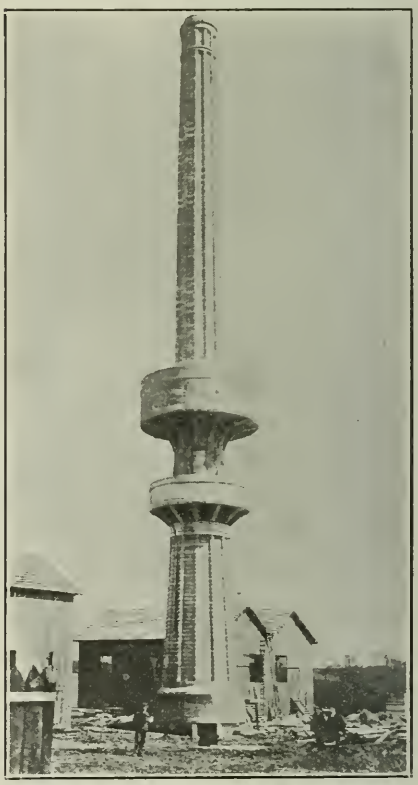
CONCRETE BLOCK WATER TOWER AT INTERNATIONAL EXPOSITION, BRUSSELS, BELGIUM.

ly, will be covered by the blocks in the courses above.

Each block has at one of its extremities, a "hook" similar to the shape of the letter "U." This "hook" forms a hollow space which extends the full length of the chimney, and of course, there will be just so many of these hollow spaces as there are sides to the chimney. Through these vertical hollow spaces are placed around the iron rods, varying in diameter according to the height of the structure. At each course these rods are tied or bound to the courses by U-shaped flat pieces of iron. These in turn, are wired to a small iron rod which is placed between the courses horizontally and in a groove made for it in the top of the block.

The placing of the vertical rods in the openings and not in the substance of the shaft proper, forms an important advantage of this system. The reinforcement is thus kept at a low temperature, and is not subject to the injurious effects which would arise from unequal expansion if the steel was in the center of the mass. Ferro-concrete is indestructible by fire, so long as the temperature of decomposition of concrete is not reached, but it must be remembered that although the co-efficients of expansion of cement and iron are the same, the co-efficients of conductibility are very different, and fracture is likely to arise if from this cause, the temperature of the iron exceeds that of the concrete. Consideration of this condition is especially important in the case of a structure which is heated on one side only, such as a chimney.

A very clever idea in connection with the design of the blocks is that there is need for only three, or at the most, four sizes of blocks for the average chimney



CONCRETE BLOCK CHIMNEY WITH TWO TWO REINFORCED CONCRETE RESERVOIRS

of 150 feet in height and with a taper of one to three per cent. This is made possible by the following arrangement: The molds by which the blocks are made consist of but three cast iron plates, held

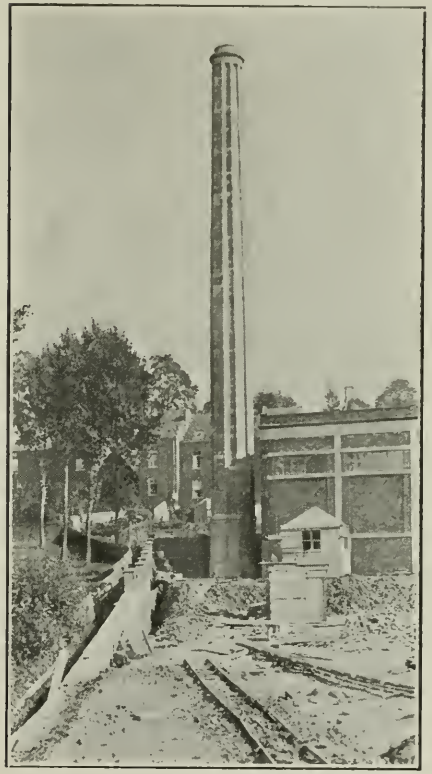
together by wooden stop blocks, and three ordinary iron clamps. Different sizes of blocks can be made, therefore, by simply changing the relative positions of the plates and the wooden stop blocks. After the blocks are molded, they are placed in the following manner: Take, for instance, the first row, which is of course placed on the base. Here naturally, the blocks are of the largest size, and the arm of the block the longest. The arms of the blocks in this course are placed just to the edge of the hooks of the blocks, and in the next course the arms are placed just a little farther into the hooks, and thus each succeeding course has a diameter smaller than the one below it, and in this manner, the taper of the chimney is obtained. As the longest blocks are some three feet in length and the distance across the semicircular opening about six to eight inches, it is possible to make a considerable taper in this manner. For a taper of one and one-half to two per cent., the size of the blocks is changed every 40 or 50 feet. The blocks may, of course, be laid with absolutely no taper, when the one size only of blocks is used. Some chimneys have been constructed on this plan but their appearance is not so graceful as those having a slight taper.

The concrete blocks are usually made at the chimney site, although this can be done at a concrete block factory, and this may be economical in case there are several chimneys under construction in the same district. The proportions for the concrete mixture vary somewhat, but the usual mixture consists of about five parts gravel, three of sand and two of cement. Dust of stone is used sometimes, and has given very good results.

From an architectural point of view, the chimneys constructed with this system present a pleasing appearance. Being thinner than brick chimneys, they rise more gracefully from their bases, and yet the strength and stability which they actually possess is at once suggested to the eye by the appearance of strength which is presented by the protruding rounded angles.

A number of chimneys and water towers have been built in Europe after this system, and the three photographs presented in connection with this article show a water tower, a combined water tower and chimney, and a chimney.

The water tower shown in the first photograph is located in Uccle, a suburb of Brussels, Belgium, and was used in connection with the 1910 Exposition held in that city. A general idea of the tower can readily be obtained by the photograph. It was built by Leon Monnoyer et Fils, concrete contractors of Brussels, who are the architects as well of the structure. The tower and tank have a height of 145 feet and the latter has a capacity of 280,000 gallons. The structure is circular and is built entirely of concrete blocks and without molding of any kind excepting that used in the building of the concrete reinforcing struts surrounding the base of the tank proper. The inside of the tank is built up in practically six stories, connected by a winding stairway. These different floors are divided into rooms, and these apartments, if they may be so called, were all occupied by engineers, foremen and other workmen during the Exposition. The stairways are placed along the outer



CONCRETE BLOCK CHIMNEY.

walls and the water remains in the center and enclosed by a concrete covering of rectangular cross sections. The tank has a concrete top, the center of which will rest on a continuation of the water mains or pipes. Excellent light is afforded the apartments by the large windows. The most interesting feature of the structure, aside from its artistic merit, is the manner in which is built up by the aid of the concrete blocks, previously described.

The second photograph shows a concrete block chimney with water tanks of reinforced concrete at Anderney, France. It is 180 feet high. The larger reservoir

has a capacity of 3,532 gallons, and the smaller of 777 gallons.

The third photograph shows a concrete block chimney.

When a municipality desires to build a water tower or a chimney connected with the same municipal building, they figure, of course, only upon the service which these structures are expected to perform and therefore the artistic side is almost wholly neglected in this country. However, in the case of these particular constructions there is no necessity for them not to use a simple and artistic structure, as the cost of such constructions with this system is materially less than any other permanent structure. It is just as easy to combine beauty and simplicity with cheapness as not. Of course it will be some time before the American municipalities are governed by men who are both business men and artists, but nevertheless it is well to look forward to the time when they will be governed by such men.

Slot Machine Lights.

The question is occasionally brought up by those sober-minded citizens who stay at home nights as to why they should be obliged to pay for lighting the homeward footsteps of the more convivially inclined. The justice of the common practice has perhaps never been actively assailed in this country, but from one town in Germany comes an item concerning an innovation which surely must have been caused by the protests of the sober-minded ones.

The village of Zarkau, near Glogau, in Silesia, has just installed an automatic "pay as you enter" street lighting system. The electric lights burn every night from the outskirts of Glogau through to the village of Zargau, a distance of about a kilometer, until 10 o'clock, at a mutual cost to the community in general. Then they are switched out.

At each end of this kilometer stretch, on an iron pillar, stands a small iron cupboard, lighted by a tiny electric light. Those persons who are out after 10 o'clock, wishing to have their way lighted, must insert a ten-pfennig piece into a slot in the side of the iron cupboard. Then the nine lamps placed along this stretch burst forth into a twelve-minute life, thus enabling the wayfarer to find his way in light.

The scheme is working in a satisfactory way, and it seems quite probable that other German villages and towns will follow the example of Zarkau and install the automatic lighting system.

Public Lights in Chicago.

At a meeting of the trustees of the Chicago sanitary district, on September 28, a contract was entered into providing for the lighting of the streets and public buildings of Chicago.

According to the contract, the sanitary district is to do more than merely furnish from the electrical energy developed by its water power at Lockport current for lighting the city. It is to take over the city's electrical stations and sub-stations, with their appliances and other electrical equipment, and make whatever additional installation may be necessary to the furnishing of light. The operation of the system for the life of the contract, seven years, will be in the hands of the sanitary district authorities.

The city has in operation at the present time approximately 12,200 arc lamps. The number is to be increased as speedily as possible by the addition of 10,000 lamps. Thus the public lighting facilities will be nearly doubled. For this service the city is to pay the district yearly $15 a horse power for electrical energy used, and, in addition, $1 a year as operating charges for every arc light of 450 watts capacity. The capital expenditures by the district are to be repaid by the city during the period, so that at its expiration the city will be in a position to resume operation of the lighting system, merely purchasing current from the sanitary district.

In the report submitted to the city council, Alderman Foell, chairman of the finance committee, stated that after the rehabilitation of equipment and the addition of 10,000 lights the cash cost of operating the 22,200 city lamps will be less than the cost of operating the present system of 12,200 lamps. After allowing for interest and depreciation on the present as well as on the future investment, the cost of operating and maintaining the enlarged system will be only 17 per cent. in excess of the present cost of operating and maintaining the 12,200 lamps.

This contract will secure great advantages for the city and is quite in contrast with the condition at Buffalo, where no benefits are derived by the city from the enormous Niagara Falls power development.

PAVING

Paving Brick Plant—Road Binding Materials—Licensed Contractors

The Ohio Experiments on Road Binding Materials.

During the summer and fall of 1909 the State Highway Department of Ohio, in cooperation with the manufacturers of materials for treating roads built a series of experimental sections of road on Nelson avenue, a cross road on the outskirts of Columbus, O., the improvement being crossed by the Columbus, New Albany and Johnstown interurban, by which it is quickly reached from the city.

The details of construction, materials used, etc., are given in Bulletin No. 12 of the State Highway Department, issued in January, 1910. A supplemental report on the condition of the sections in September, 1910, is given in Bulletin No. 13. The writer inspected the road in July, 1910.

The first section was treated with Glutrin, described by the manufacturers as a "calcium-magnesium-ligno-sulfonate." A macadam road was sprinkled with water and then with the glutrin in two applications a day apart, one gallon to the square yard in all. Cost $560.78, or $453.99 not including Glutrin.

The road was hard but dusty in July, and, except for a bronwish discoloration, had the appearance of water-bound macadam in September. Apparently requires annual treatment with the glutrin.

The second section was treated with Standard asphalt binder of the Standard Oil Co. with the application of 1½ gallons per square yard to the rolled second course to which screenings were applied as required, a second treatment with ¼ to ½ gallon per square yard and more screenings. Cost $446.69 not including asphalt binder. The road had a hard surface, was only slightly dusty, although the oil only showed slightly in July. In September the asphalt had exuded so as to cover about half the surface and showed marks of horses' shoes.

The third section was treated with Pioneer asphalt cement of the American Asphaltum and Rubber Co., with the application of 1¾ gallons on the second course of macadam after about half the voids had been filled with screenings well broomed in. More screenings were spread on the cooled asphalt in advance of and along with the rolling until the coating was all absorbed. Cost, $663.26, or $586.02 not including Pioneer asphalt. In September the surface was smooth and in excellent condition, all pieces of stone being perfectly bound with no excess of binder.

The fourth section was treated with Tarvia X, of the Barrett Mfg. Co., with the application of the hot tar under pressure, 1¼ gallons per square yard on the second course of 1½ to 3-inch stone, and ½ to ¾ gallon after screenings had been rolled into the course of tarred large stone, on top of which a protecting coat of screenings well rolled. Cost $570.80, or $437.60 not including Tarvia X. The stones were well bound with no excess of tar, stones showing in spots. This section is somewhat dusty, doubtless from traffic from the cross road here.

The fifth section was treated with Tarvia B, of the Barrett Mfg. Co., applied on a macadam road filled and rolled dry and after two weeks travel over it, the dust and dirt being swept off, and 2-3 gallon per square yard sprinkled on warm enough to run freely, after which the sweepings were swept back over the surface. Cost $497.24, or $464.69 not including Tarvia B.

This had much the same appearance in July and September as the preceding section and had little or no dust.

The sixth section was treated with liquid asphalt of the Indian Refining Co., applied hot in the same manner as on Section 3. Cost $500.09 not including the liquid asphalt. The binding material showed but slightly on the surface in July and September, but the stones of the wearing surface were apparently held in place by the binder below, which was more viscid than usual in such fillers.

The seventh section was treated with Ugite, made from water-gas tar. Part of the area had 2.05 gallons per square yard poured hot on the top course after rolling ¾-inch stone into it, on which ¾-inch stone, then ½-inch chips and then ¼-inch screenings and dust, were rolled separately until firm. Part of the area had 1.67 gallons poured hot on the top course filled with the ¾-inch stone as above, the course of ¾-inch stone being then rolled in, on which 0.44 gallons of Ugite was poured, then the ½-inch chips were rolled in and later the ¾-inch screenings and dust. Cost $651.98, or $559.58 not including Ugite. There was no apparent difference between the two methods of application in July or September and the appearance and condition was very similar to Section 6.

The eighth section was treated with Fairfield asphaltic cement, applied hot on the second course of macadam after rolling, then applying ½ inch of stone chips which were thoroughly rolled. The quantity used on the 400 feet of road was 13,350 pounds of very heavy viscous as-

phalt. Cost $602.90, or $487.55 not including the asphalt. This section was in excellent condition in July and September, the surface slightly rougher than some of the tar-treated sections.

The ninth section was treated with asphaltoilene, applied hot in very nearly the same manner as Section 8. Cost $568.38, or $452.06 not including the asphaltoilene. The asphalt covered the surface in part in July and September, being dustless and acting much like a soft asphalt surface, but part of the wearing surface was the stone, held in place by the binder below.

The tenth section was Wadsworth macadam, being an inch of finely ground Kentucky rock asphalt applied to the top course of macadam, prepared as on Section 9, thoroughly rolled and an additional inch again rolled. It was applied in warm weather without heating. At the beginning the surface was tracked easily by wagons and marked badly by horses' shoes, but after some months it became like an asphalt surface and in July and September appeared to be an asphalt pavement and was in better condition than at the beginning. In July it showed marks of the recent passage of a traction engine. Cost $751.70, or $606.65 not including the asphalt.

The eleventh section was treated with Carbo-Via applied hot about the same as on Section 9, 1⅛ gallons per square yard from hand sprinkling cans at the first application, and the roller oiled with an emulsion of kerosene and water to prevent sticking, stone chips being then swept into the voids and again rolled, followed by ½ gallon of Carbo-Via again rolled, ¾ inch of stone screenings applied and again rolled. Cost $568.95, or $460.40 without the Carbo-Via. In July and September this section was quite similar to Section 4, except slightly rougher, although the thick coating of screenings on top had made it quite dusty during its early life.

The twelfth section was a concrete macadam, made the same as water-bound macadam, except that Portland cement was mixed with the screenings for the binder of the top course one of cement to six of screenings, which were then applied dry and water applied until a wave of grout appeared ahead of the roller all over the surface. The section was closed to travel and kept damp by sprinkling for several days. Fifteen barrels of cement was used on the 400-foot section. In July the stones projected, making a noisy pavement, and the surface appearance is reported to have been from the beginning similar to water-bound macadam. Cost $481.44, or $464.34 not including the cement.

The thirteenth section was treated with Taroid of the F. J. Lewis Mfg. Co. The lower course was of rather small stone filled and rolled. The second course was of 1½ to 3½-inch stone 3 inches deep, treated as in Section 3 with 1 to 1½ gallons per square yard, done by hand, and rolled when partly cooled. Coarse sand was then rolled in. Cost $596.70, or $503.49 without the Taroid. This had good surface, showing some stones, and evidences of excess of tar at the sides where it has run out over the adjoining ground surface.

The fourteenth section was Petrolithic pavement, laid according to the specifications of the inventor. Cost $622.60. The asphalt exuded when the heat of summer began so that travel avoided the road. It was repaired by adding 2 inches of screened gravel, which was well rolled in, the repair, except rolling, costing $50.15. Only gravel showed on the surface in July and in September the road was rutted by vehicles, gravel showing outside the line of ruts.

The fifteenth section was limestone concrete, 1 cement, 3 screenings, 6 stone, machine mixed with little water. Slow rolling resulted in wavy surface. Depth, 6 inches with several vertical transverse joints. Cost $668.69. This section showed few cracks and some indentations in July. In September some of the junctions of days' work showed wear. About half the section was in very good condition and the other half not so good.

The sixteenth section was gravel concrete, 1 barrel of cement per cubic yard, mixed wet, placed 6 inches thick and formed by dragging a template over it. No joints, so slab is 6 inches thick, 16 feet wide, 400 feet long. Some transverse cracks like joints and a few other cracks showed in July and the surface was smooth. There was little sign of wear in September and the surface afforded good footing for horses. Dustless, and transverse cracks did not show wear. Cost $507.90.

The seventeenth section was ordinary water-bound macadam. In July the surface binder had been removed in part, showing the stones, and a few ruts had appeared. In September the surface had still further disappeared, but the condition was still considered satisfactory.

The measured wear on the center line varied from 0 for the glutrin and gravel concrete to 0.07 foot for the Carbo-Via, being the averages of five stations. The maximum wear shown was 0.09 feet near one of the outside edges of the Standard asphalt section, also the average of five stations.

Hammond Contractors Licensed.

An ordinance has been passed by the City of Hammond, Ind., providing for the licensing of contractors engaged in sidewalk work. This ordinance contains some novel features which may be stated briefly as follows:

Any person, firm or corporation desiring a license to engage in the business of constructing and building sidewalks for other people under contract within the

city of Hammond shall make application, in writing, for such license to the Board of Public Works, setting out in such application the full name and residence of the applicant. Such applicant shall file with Board of Public Works a bond with sureties to be approved by the Board of city against any damages on account of Public Works in the sum of five thousand dollars for the purpose of indemnifying the city against any damages on account of accidents during the construction of a sidewalk built by the person procuring such license and conditioned further that the licensee shall repair and replace any defective sidewalk for a period of three years from the time of completion of any such sidewalk constructed by said licensee after written notice. The bond shall not have less than two free holder sureties, or some approved surety company, all to the approval of the Board of Public Works. Upon the approval of the bond the Board of Public Works shall approve the application for such license by endorsing their written approval thereon in writing and the city controller shall thereupon issue to the applicant an annual license to engage in the business of constructing and building sidewalks upon the payment by the applicant to the city treasurer the annual license fee in the sum of twenty-five dollars.

Further provision is made that on condition of a defective sidewalk requiring repairs, the contractor shall be notified and given 15 days' written notice to repair the damage. In event of failure to do as requested the work shall be let to some other party and the expense shall be charged against the bond and the licensee shall be suspended from receiving further permits or doing any further work until the expenses shall have been taken care of.

An Up-to-Date Brick Plant.

The United Brick Company of Conneaut, Ohio, was one of the first plants to adopt the Dunn system of Wire Cut Lug Brick and their method of handling the process might be found interesting.

The institution has a capacity for making thirty thousand bricks in a ten-hour day. There are seventeen circular kilns, sixteen of which have a capacity of thirty-five thousand bricks each. The other is rectangular and has a capacity of one hundred thousand, and these are being run to their full capacity all the time. The pressure from the trade is such, however, as to make additional facilities necessary, and at an early date larger kilns of the rectangular type will be constructed. The output of the brick plant, running a ten-hour day, is about a million brick a month.

The process of manufacturing brick at this plant is interesting. The blue shale rock is hauled up from the clay pit on an inclined tram. A syphon pump keeps the pit dry. At the top of the tramway the shale is dumped from cars into a bin, and the shale is fed through a spout into two crushers, each with a capacity of seventy-five tons per day. Under the crusher revolves a bed plate, the periphery of which is a screen. The centrifugal motion of the plate throws the crushed shale upon the screen, and the finer particles sift through. The coarser particles are again thrown upon the crusher. The screened shale is taken up by a bucket to the top of a building, and is again screened. The coarser grains are returned by gravity to the crusher, through which they again pass. The weight of each crusher is sixteen tons.

After the final grinding and screening the shale goes into a bin and thence into a pug mill or tempering machine, which mixes the shale with the water to the proper consistency. The tempered shale or clay is then conveyed automatically to the auger machine. The auger or propeller forces the clay through a die in a column the thickness of a brick; the width of the column representing the length of the brick; an endless belt carries this column horizontally to the cutting machine, the weight and adhesion of the column carried along by the machinery causing the belt to revolve.

In the process of cutting the clay into brick, a frame is automatically lowered immediately prior to the wires entering the clay, and raised immediately thereafter, thus clamping the clay during the cutting operation, yet releasing it while it is in motion over the platen. This clamping feature prevents the clay moving on the platen during the cutting operation, and this makes crooked cuts impossible.

Round edges of any desired radius are obtained by making plates with flanges which indent the clay when it is clamped between them. Any configuration placed on the plates will leave its imprint on the brick. This makes it possible to place any desired design on the surface of the brick. Ordinary branding of the brick with the manufacturer's brand is accomplished by rolling the design on the clay column, the size of the brand being small enough to insure getting one on each brick.

To make brick with lugs, the slots in upper and lower platens are made with off-sets therein at any desired point. Therefore, the wires being deflected by these off-sets, leave ribs or lugs across the one face of the brick and corresponding grooves in the adjoining brick. The clay column being protected and held firmly by plates with slots or spaces between the plates only large enough for the free passage of the wires, makes it possible to cut as true, clean edges as can be obtained by repressing, and this, too, with a reciprocating movement of the wires.

When the bricks leave the cutting machine and are carried forward, all excess clay and such of the bricks as

may be carried past the car, drop into a bin and are automatically conveyed back to the auger machine. In fact, almost all the work of transporting materials is done automatically.

After they are cut into bricks, the blocks are carried forward on a belt, from which they are taken and placed on a car and pushed into a drying tunnel. There are ten of these tunnels, each holding eleven cars. The tunnels are heated by means of the waste heat from the kilns, the heat being drawn by a fan through the underground passages to the tunnels by a 35 h. p. engine.

From the drying tunnels the blocks go to the kilns and are exposed for 12 days to heat which attains 1900 degrees temperature.

ORGANIZATIONS AND INDIVIDUALS

Good Roads Convention—American Society of Engineering Contractors—Technical Meetings—Technical Schools—Civil Service—Personal Notes

The Southern Appalachian Good Roads Convention.

One of the features of the Appalachian Exposition, held in Knoxville, Tenn., during the first days of October, was a good roads convention which attracted a wide interest. The organization is only about one year old, but a great deal of good has been accomplished in its comparatively short existence and its membership includes the governors of Tennessee, Kentucky and South Carolina. Mr. Joseph Hyde Pratt is president.

Among the paper of interest to our readers, the following were perhaps the most important:

"Convict Labor in North Carolina," by W. L. Spoon, highway engineer, North Carolina.

"Top-soil Method of Road Construction used in Clark county, Georgia," by C. M. Strahan, professor of civil engineering, University of Georgia.

"Road Legislation and the Automobile as a Factor in the Good Roads Movement," by Henry R. Brown, of Tennessee.

"Speed Limits of Automobiles on Public Roads," by George C. Diehl, Buffalo, N. Y.

"To What Extent Do Automobiles Destroy Our Roads," by L. W. Page, director office of good roads, Washington.

A general educational bureau was conducted by the government with lectures and an exhibit.

The exhibit consisted of a number of models built on a scale of 1 1-2 inches to the foot and illustrating fifteen standard types of roads in use in various parts of the United States. One of the most important features of the exhibit is that which showed the use of asphaltic oil and tar as dust palliatives and preventives, and for the preservation of macadam roads.

A miniature crushing plant and steam roller in actual operation as well as a complete outfit of earth handling machinery were also shown.

The following is a brief description of the model roads:

The model earth road illustrated a section of poorly drained earth road; a section which is well drained and crowned with a road machine; another on which the ruts and holes are being filled with a split log drag.

The oiled earth model showed a section of dusty roads; same road plowed, harrowed and ready for oiling; asphaltic oil spread on plowed surface; mixing oil and earth; finished road.

The sand clay model was that of a section of on old sandy road; same rounded up ready for clay; 6 or 8 inches of clay spread on; mixing clay with disk or tooth harrow when wet; finished road after being shaped with road machine.

The gravel road model showed prepared subgrade and gravel shoulders; first course of gravel spread and rolled; second course of cementing gravel and finished road.

Gravel macadam model included the prepared subgrade with earth shoulder as in regular macadam road with shoulder drains; first course gravel; second course of cementing gravel; and finished road.

Telford model showed prepared subgrade and earth shoulders. Telford base of rock laid by hand; layer number one of crushed rock; layer number two of crushed rock; coating of binder; screening and dust; finished road.

Macadam road included the subgrade with shoulders of earth and shoulder

drains; number one course of 2 to 2 1-2 inch rock placed to a depth of from 6 to 8 inches rolled; number two course of 1 to 1 1-2 inch rock rolled to a depth of from two to four inches.

The tar macadam road model showed dusty macadam surface; same swept and cleared; hot bitumen broomed into the surface; sand and stone screenings spread to take up surplus bitumen. Sections of tar macadam roads built in Washington, D. C., in 1872-3-5-7 are also shown to illustrate the life of this class of construction.

Other types were illustrated in a similarly complete manner and full descriptions of each type of road were available. In setting forth the method of construction of three various kinds of roads, tiny models of road machinery, crushing plants, quarries, etc., were shown in operation.

This valuable exhibit together with the papers which are mentioned elsewhere in this issue serve as indications of the value of the convention.

The American Society of Engineering Contractors.

The Annual Convention of the American Society of Engineering Contractors was held in the Coliseum at St. Louis September 26th to 28th, inclusive. The meeting was well attended considering the fact that it was held during a time when most engineering contractors are busily engaged in rushing their jobs to completion before the winter season. The enthusiasm and earnestness of those present in a measure was a compensation, and a great deal was accomplished along the lines for which the society was organized.

Two of the papers presented at the convention were given in the October issue of MUNICIPAL ENGINEERING. A third paper, by Edward Wegmann and J. B. Goldsboroug,h of New York City, on "The Construction of the New Croton Dam" was one of the most interesting papers of the session. It was accompanied by many stereopticon views, necessary to the full appreciation of the paper.

During the convention an inspection trip was made to "The Chain of Rocks," where St. Louis' great water supply is treated with lime and iron to cause sedimentation. This trip was made particularly interesting from the discussions by men who had been connected with the water supply problems of other cities; notably Mr. Edward Wegmann, who was connected with the water department of New York City for a number of years.

The Engineers' Club of the City of St. Louis was prominent in the success of the convention, and to them and the local committee is due great credit for the success of the meeting.

Technical Meetings.

The seventh annual convention of the National Association of Cement Users will be held in the Concert Hall of Madison Square Garden, New York City, December 12 to 23.

The annual meeting of the American Roadbuilders' Association will be held in Indianapolis, December 6, 7, 8 and 9.

The thirteenth annual convention of the League of California Municipalities will be held at San Diego, November 15, 16, 17, 18 and 19. The program in part will be as follows: "A Discussion of the Commission Plan of Government," led by Commissioner A. E. Dodson, of San Diego, followed by Mayor Beverly L. Hodghead, of Berkeley, and others. "City Planning," by Dana W. Bartlett, of Los Angeles, illustrated with stereopticon views. "Sanitary Conditions in California Cities," by Dr. W. F. Snow, of the State Board of Health, illustrated with stereopticon views taken from cities and towns in different parts of the state. "Conservation of Municipal Water Front," by Stephen G. Long, city attorney of Long Beach. "Assessor's Duties," illustrated with records, forms and maps, by D. D. Kellogg, assessor of Pasadena. "Cement and Cement Testing," by William B. Gester, of the Robert W. Hunt & Co., one of the largest engineering firms in the world. "Standard Specifications for Oil Macadam Pavement," illustrated with steropticon views taken from different parts of the state, by Engineers S. J. Van Ornum, of Pasadena, and Orlin Hudson, of Richmond. "Suggested Modifications of the Vrooman Act," by Hugh R. Osborn, city attorney of Santa Cruz. "The Fly Evil" and "The Impure Milk Evil," by speakers from the state board of health, illustrated with two reels of moving pictures, secured expressly for this convention. The rights of telephone companies to erect poles in the streets, the Warren Bros. patent pavement, the Cameron septic tank litigation and modification of the Vrooman act will be special subjects to be taken up by the city attorneys present.

The annual meeting of the New Jersey Sanitary Association wil be held at Lakewood, N. J., December 2 and 3. J. A. Exton, secy., 75 Beech st., Arlington, N. J.

The annual meeting of the American Society of Mechanical Engineers will be held at New York City, December 6, 7, 8 and 9. C. W. Rice, secy., 29 W. 39th st., New York City.

The annual convention of the Association of American Portland Cement Manufacturers will be held in New York City, December 12, 13 and 14. Percy H. Wilson, secy., Land Title bldg., Philadelphia.

A meeting of the American Institute of Electrical Engineering was held, Oct. 17, in the United Engineering Socities bldg., New York City. It was announced as a "public engineering meeting," to discuss

the rapid transit situation in New York City. A paper on "The New York Sanitary Situation" was presented by Frank J. Sprague, which was folowed by four or five invited speakers called upon for discussion.

The New York Cement Show will be held in Madison Square Garden December 14 to 20, 1910, and in connection therewith the National Association of Cement Users and the Association of American Portland Cement Manufacturers will hold their annual conventions.

The Chicago Cement Show will be held at the Coliseum February 17 to 23, 1911. Both the New York and Chicago shows are under the management of the Cement Products Exhibition Co.

The National Municipal League will hold its annual meeting in Buffalo, N. Y., November 14 to 18. An excellent programe is in preparation.

At the meeting of the Brooklyn Engineers' Club Oct. 13, Wm. T. Donnelly presented a paper on "The Electrification of the Works of the John N. Robins Co." The informal library talk on Oct. 20 by Snowden B. Redfield was on "The Air Compressor," and that of Nov. 3 by A. R. Maujer will be on "Chimneys."

A most unique feature of the meeting of the Illuminating Engineering Society at Baltimore, Md., was a series of lectures on illuminating engineering under the joint auspices of the society and Johns Hopkins University, by the experts in the field. There were three of these lectures each day, at 9, 11, and 2, beginning Oct. 26 and extending to Nov. 8.

Extensive preparations are in progress for the World's Congress and Exposition on Government of Cities to be held in Chicago Sept. 18 to 30, 1911.

The Munncipal Engineers of the City of New York listened to a paper on "The Pavement Problem in the Borough of Manhattan," by Geo. W. Tillson, chief engineer of highways, at its meeting Oct. 26.

The Technical Schools.

The July number of the Record of the University of Tennessee gives a full, well-illustrated description of the facilities for technical education in the institution, which is located at Knoxville, Tenn.

The extension division of the University of Wisconsin issues frequent bulletins giving material to prepare students for debating and public discussion. No. 379 is devoted to the commission plan of city government and gives the Wisconsin act on this subject in full.

The first bulletin of the Pennsylvania State College gives a statement of the purpose and work of the engineering experiment station and two papers on efficiency of incandescent lamps and construction of concrete floors.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

Nov. 22, 23: For deck officer and similar vacancies, coast and geodetic survey, age 18 to 24, at $720 with rapid advancement.

Personal Notes.

Earnest Warbutton has resigned as city engineer at Crawfordsville, Ind.

C. P. Wells, of Aberdeen, S. D., has been appointed city engineer at Redfield, S. D.

Ernest McCullough, consulting engineer, specializing in municipal work, has moved his office to the Fisher bldg., Chicago.

Charles K. Mohler has established an office at 1839 McCormick bldg., Chicago, Ill., and will practice as consulting engineer.

David A. Hartwell, who has been city engineer of Fitchburg, Mass., for 20 years, has resigned to become chief engineer of the sewage disposal commission of that city.

F. W. Stevens and George F. Baker, Jr., have been elected directors of the Atlas Portland Cement Company, at Chicago, Ill., to succeed F. L. Hine and George F. Baker.

Prof. C. E. Freeman, electrical and mechanical engineer, and H. G. Raschbacher, irrigation engineer, have joined the Chicago staff of W. H. Rosecrans, consulting engineer.

S. D. Sarason has resigned as assistant in the U. S. Coast and Geodetic Survey, to accept a position as instructor in civil engineering at Syracuse University, Syracuse, N. Y.

Prof. Joseph B. Davis, associate dean of the civil engineering department of the University of Michigan, tendered his resignation Oct. 8, and was made professor emeritus of surveying by the board of university regents.

R. H. Gillespie, formerly chief engineer for the John J. Hart Company and the F. V. Smith Constructing Company, New York City, has been appointed chief engineer of sewers and highways, Borough of Bronx, New York City.

The Goldsborough Company has been organized in Denver, Col., to conduct a general engineerng and construction business in civil, hydraulic, electrical and mechanical lines. W. E. Goldsborough is president of the new company.

Major W. W. Harts, M. Am. Soc. C. E., of the U. S. Engineers Corps, has been awarded a Telford gold medal by the Instiution of Civil Engineers of Great Britain, for a paper submitted to that society and published in Transactions for 1909-10.

L. J. Towne, formerly with the bridge and building department of the Chicago, Milwaukee & St. Paul Railway at Chicago, has been appointed adjunct professor of civil engineering in the University of Nebraska, at Lincoln. He suceeds Prof. Alfred Boyd, who has gone to the University of Oklahoma.

William T. Reed, Elmer E. Tucker and E. F. Rockwood, formerly with the Eastern Expanded Metal Company and the Eastern Concrete Construction Company, Boston, Mass., recently organized the New England Concrete Construction Company, and are prepared to design and build concrete and reinforced concrete structures of all kinds. The company has established offices in the new Boston Safe Deposit & Trust Company building.

MACHINERY AND TRADE

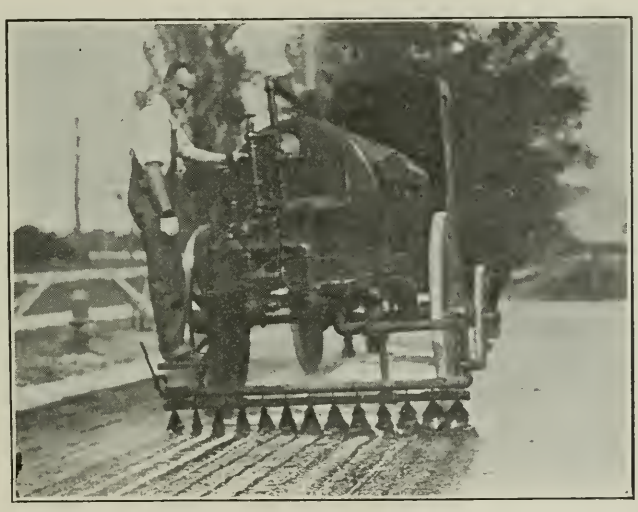
A Pressure Road Oil Machine.

During the recent Good Roads convention in St. Louis occurred the first practical demonstration of something entirely unique in the field of road treatment. The accompanying photograph, taken at that time, illustrates the demonstration mentioned.

A small 3 h. p. gasoline engine was attached to the rear of one of the ordinary type of the Standard Oil Co. road oil wagons. This engine operated a Gould pressure pump, delivering the road oil through the pipes as shown, to the outlet pipe, where a pressure of 25 lbs. is maintained. Connected to this outlet pipe are 13 jet nipples of such a shape as to spread the oil in the fan-like form as shown. By means of the lever shown attached to the outlet pipe, immediately beneath where the operator is standing, the quantity of oil flowing may be regulated to spread from ⅛ to ¼ of a gallon per square yard, or more if desired. In addition to the pressure pipes leading direct to the pump, there is an emergency pipe leading from the tank, so that the sprinkler may be used without the forced jet if desired.

The pressure sprinkler is designed to handle any kind or grade of road oil, no change being necessary to adopt it to the heavier oils. The tank to which it is attached is of a capacity from 600 to 700 gallons.

The demonstration on Lindell boulevard in St. Louis was made before a number of delegates to the Good Roads convention. The road selected was of water-bound macadam, which had been swept free from dust and dirt, leaving the surface as hard and nearly as impervious as concrete. As will be seen from the photograph the oil was spread evenly over the surface without leaving the pools and dry spots which seem unavoidable under the old sprinkler system. The pressure method of application seemed to incorporate the oil into the surface material almost at once, even under the unfavorable condition of an almost impervious road surface.



PRESSURE ROAD OIL TANK.

For further information relative to the machine, address the Road Oil Department of the Standard Oil Co., New York City.

Ceresit.

"The Efficient Economical Waterproofing" is a small booklet advocating the use of ceresit waterproofing. Examples of the use of the compound, arguments in its favor and directions for its use are given. The most noteworthy examples of its use, given, are in Ger-

many, the Ramholz and Ruppertsberg tunnels being the most prominent. A leaflet of testimonials and one of specifications accompanies the booklet.

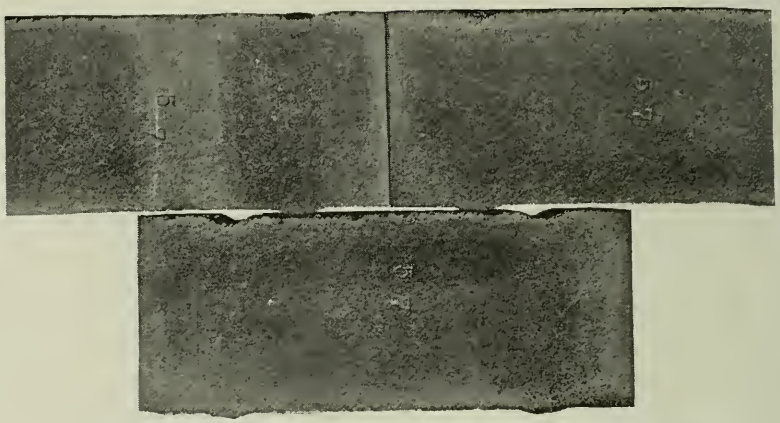
Wire Cut Lug Blocks.

With the advancement in paving construction, which has come through the understanding of the right use of brick paving fillers, there has been a decided step forward in the manufacture of brick. The necessity for providing some means of holding the brick apart to allow the filler to penetrate between them has long been recognized and the method of repressing has been, so far, the only means of obtaining lugs or ridges to provide the space desired. Mr. Frank Dunn has an invention which gives the desired results without the bad features of repressing.

The invention consists of guides, either rigid or in the form of rolls, attached to the platen of the cutting table and projecting over the line of travel of each wire as it passes through the clay column, thus deflecting the wire and forming a rib or lug across the face, or rather the side of a side-cut brick. This also makes a corresponding groove in the adjoining brick, but the groove can be easily removed by attaching extra wires to cut off sufficient clay, which will immediately return to the auger machine over the waste clay conveyor. The groove, however, is generally considered an advantage to the brick, as it admits the filler more freely. Photograph No. 1 shows the effect of the wire cutting lugs in separating the blocks for the bonding material.

Engineers have for years past specified repressed brick or blocks, as this was the only paving material that by reason of the lugs formed in repressing, could insure as much as possible the admission of the filler between the bricks, in order that a bond might be obtained, which would not only make the pavement more rigid, but water-proof also. The accompanying photograph No. 2 shows a case in which an effort was made to break the bond between wire cut lug brick with the result that the brick themselves were broken and the bond was not injured. With the square corners and the ample provision for the admission of a good cement filler, the wire cut lug brick will give a smooth lasting and perfectly waterproof pavement.

Photograph No. 3 shows the simplicity and ease with which the brick may be laid in place, the regularity of the lugs and their accuracy of cutting assuring against irregularity and varying joints. The joints obtained are of uniform width and in straight lines, as is shown in photograph No. 4. This assures the rapid and complete filling of all joints and a smoothness of surface, almost impossible of attainment with irregular joints.



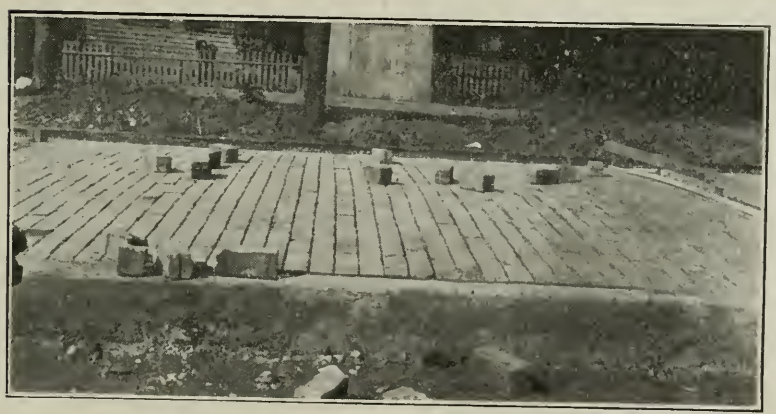
1. SHOWING AMPLE SPACE FOR FILLER WITH WIRE-CUT LUG BRICK.

The one great advantage of the round cornered brick has been to the manufacturers' credit rather than an advantage to the pavement. It has been shown that the round cornered brick do not lose as much under the abrasion test as those having square corners. In spite of this fact samples of wire cut lug block submitted to the Ohio State University laboratories and to the testing laboratory of the Highway Department of Ohio show a surprisingly low percentage of loss. Under the standard tests the average percentage loss for the Ohio State University samples was 19.05, while the loss for the samples submitted to the state laboratory was 18.65.

There now remains one step necessary for the general adoption of the wire cut lug block. Most cities provide in

2. SHOWING STRENGTH OF BOND OF WIRE-CUT LUG BRICKS.

3. LAYING WIRE-CUT LUG BRICKS.



4. WIRE-CUT LUG BRICK PAVEMENT READY FOR FILLER.

their specifications that repressed brick must be furnished on all contracts. Fifty-two cities have already admitted the wire cut lug blocks to their specifications, and more are intending to do so. When this has been done, manufacturers will be ready, and in fact will prefer to adopt the more advanced type of mrick. The answer is evident. The merits of the wire cut lug block should be investigated and if all that is claimed for it is true it should be at once admitted under the specifications of every city. Full information will be furnished on application to The Dunn Wire Cut Lug Brick Co., of Conneaut, Ohio.

A Portable Asphalt Plant.

Considerable difficulty is encountered under the common method of laying asphalt macadam due to the irregularity in hauling material from the plant. Even under the most careful management there are delays caused by waiting on wagons to come from the plant and the matter of keeping the gang alternately resting and rushing is never good economy.

In addition to this labor difficulty there are certain conditions of temperature and mixing that must be met in order to assure a good asphalt macadam pavement. The binder must be heated to a point which will make it perfectly liquid, without danger of "flashing" or burning; the aggregate must be dry and heated to a temperature to match the binder; the exact proportion of the aggregate and binder, to produce the best results, must be rigidly maintained by automatic measuring devices; the aggregate and binder must be thoroughly mixed and delivered fresh to the roadway at the proper temperature without danger of being chilled or separated by a long haul from a semi-permanent plant. All these essentials are furnished by the Twentieth Century Portable Asphalt Paving Plant, which is operated with a minimum crew directly in connection with the raking and rolling.

The general view shows the standard machine, which is about 27 feet long, mounted on broad-tired wheels, and moved along ahead of the work at convenient intervals by a traction engine or road roller.

The aggregate is shoveled into a hopper at the front end of the machine to be fed into the heating and drying drum, which is about 12 feet long and revolves directly over the fires. One end of the drum is seen extending through the casing and receiving the blast of hot gases, which the fan draws from the rear of the furnace and blows directly through the interior of the drum. In the detail view the lever man has dumped into the mixer a batch of hot aggregate from the measuring box, and melted asphalt from the measuring drum, and the mixer man is preparing to open the slide at the bottom of the mixer to deliver a load into the barrow. In this view of the rear of the machine will be seen the main shaft and driving connections to various parts of the machinery, and the casing which encloses the elevator, storage hopper, measuring devices, mixer, etc.

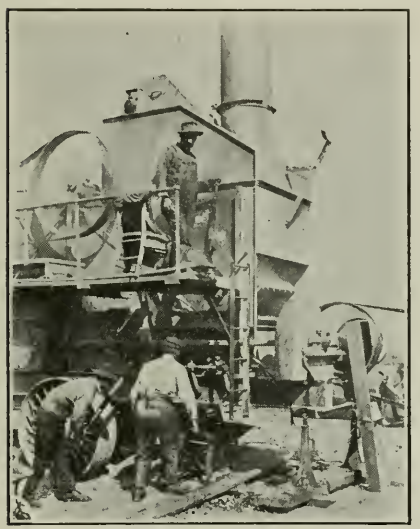
LINK-BELT CO.'S PORTABLE ASPHALT PLANT.

The average capacity of the plant under normal conditions is conservatively rated at 300 square yards of 2-inch thick paving per day of nine hours, which means about 170 to 175 dumps of the measuring box. The records of one of the machines at work in a Chicago park show an average of over 200 boxes per nine-hour day

for a month, sometimes running to 275 boxes per day. Two machines used by the South Park Board in Chicago laid about 160,000 square yards in 1909, starting in June.

One of the early pavements laid by this machine is on Michigan avenue, Chicago, between 39th and 55th streets. This has had over 500 days of heavy automobile traffic without a cent for repairs, having passed through two hot summers, and an unusually severe winter, without ruts or cracks, presenting a firm but resilient surface, smooth but not slippery, and apparently in excellent condition.

The operation of the plant is continuous and the delivery of prepared material cor-



PORTABLE ASPHALT PLANT.
Discharge End.

respondingly regular. The discharge comes in batches at intervals of two or three minutes, and the asphaltic concrete mixture is delivered to the work in carts. In daily operation the machine sets the pace for the whole work, furnishing a steady supply of fresh paving mixture to the rakers and rollers, and keeping everybody profitably busy throughout the working hours. A half hour for lunch does not involve an hour's idleness, as the full force finishes and starts work together. There is no waste from loafing, and the whole working force is under the supervision of one superintendent at all times. There is no division of responsibility for results between two sets of men and equipment. There is no carelessness from rushing, no burnt asphalt and no chilled asphalt; and the investment in real estate or buildings, cars or sidings is saved.

The machines are equally well adapted for laying sand aggregate sheet asphalt pavements, and for use of tar or other bituminous material when desired.

The Link Belt Company, of Chicago, are the manufacturers of the plant, and will gladly furnish additional information upon application.

Fire Test of Concrete Block Construction.

The concrete blocks manufactured by the Fisher Hydraulic Stone Co., of Mt. Gilead, Ohio, were recently subjected to a severe test in Baltimore, Md. A 4-story building used as a warehouse by the Patapsco Oil and Grease Co. caught fire about midnight, and owing to the quantity of oils and inflammables, was soon developed into a very threatening conflagration. So threatening was the fire that the second and third fire alarms were sent in and brought out fourteen fire engines, who were also assisted by the fire boat "Cataract" throwing a stream from the Chesapeake bay or basin, a distance of about 100 feet, into and against the burning building. This fire was fought with the same precaution as a wall constructed of brick, expecting that it would crumble and fall; three of the walls were self-sustaining and exposed. As the roof fell the flames extended high into the air. When this vent was given to the fire the inside became a roaring furnace of burning oil and oil saturated wood floors and joists.

Consider the tests the blocks were subjected to by this intense heat, and while heated quantities of water were poured on them, as through the openings and from the roofs of the adjoining buildings many streams of water poured on the top of the burning building. To the surprise of all of the fire department the walls remained unaffected, resisting these destructive elements. Thus aided, the firemen confined the fire to one building, and probably prevented another such conflagration as was experienced in that city in 1904.

When the walls would permit of inspection, still greater surprise awaited those who were interested, for not a cracked or injured block could be found and the walls stood as intact as before the fire. The mortar used in laying up this wall was burned to some depth in the joints between the blocks, making it necessary to point up before replacing the new floors. This is unquestionable evidence of the fire resisting qualities of the block, a further investigation by climbing to the very top and carefully inspecting the wall, and examining the blocks, found, as was reported, the blocks absolutely perfect and uninjured.

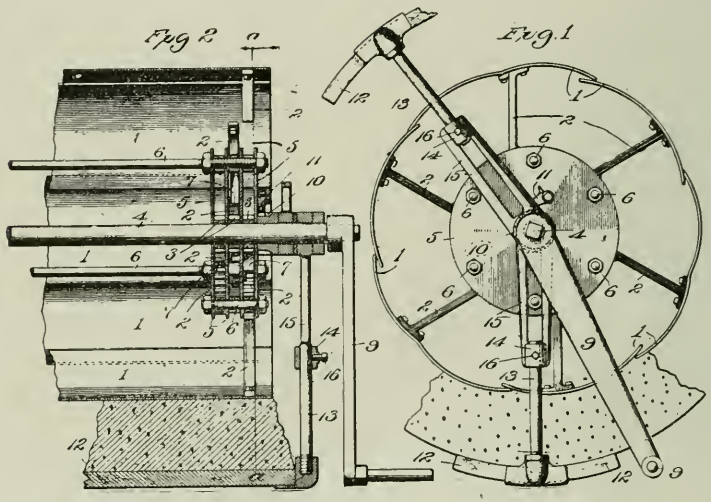
This test proves conclusively that concrete when manufactured correctly will stand where brick and other building material falls, and reveals the fact that a carefully graded aggregate thinly coated with cement, a wet mixed mortar, and then the aggregates rammed together by

powerful blows displacing the air and voids, produces a "fire proof concrete" verifying the tests made by high authority.

An Adjustable Culvert Form.

An exhibit which attracted a great deal of attention during the recent good roads convention in St. Louis was that of the Towship Supply Co., of St. Louis. In addition to a number of road graders, plows, drag scrapers, etc., there was exhibited the first one of the new adjustable culvert forms shown in the photograph and drawing accompanying.

The device is in an 8 ft. section, two sections being furnished with each set of forms. The size shown is adjustable to any side culvert varying from 14 to 24 inches; while a larger size will



ADJUSTABLE CULVERT CENTERING. DETAIL DRAWING.

be manufactured for culverts from 28 to 72 inches in diameter.

The manner of using the form is simple in extreme. The centering is placed in the position desired and adjusted to the required size by means of the crank (9). The concrete is then placed as needed. The required thickness being obtained by means of the gauges (12) set on the adjustable arms (13-16). After the concrete has set the form may be very easily collapsed, by turning the crank (9) in the reverse direction. This is accomplished through the medium of small cogs, which engage pinions on the arms (2) drawing them, and the longitudinal strips to which they are attached, towards the center. The whole form may then be drawn out without trouble.

The Township Supply Co., 2947 Lawton ave., St. Louis., Mo., are the manufacturers.

Timberasphalt.

About 8 years ago, the Santa Fe Railroad had been having a great deal of trouble with the question of the rapid decay of their ties. Untreated ties placed on that portion of their tracks through the Southwest, lasted for about 2 years and in some cases only 9 months. An experimental track was built in Texas in which the ties were treated with asphaltic oils, and these ties are still in active service. As a result of this test, they are now treating about 750,000 ties annually with asphalt oil.

The Indian Refining Co., of Cincinnati, Ohio, is now manufacturing a special product known as "Timberasphalt," for the purpose of water proofing and preserving woods. This material is composed, as its name implies, of asphalt oils which have been so successfully used under the worst climatic conditions. Other recommendations are its low cost and its ease of application.

There are several methods of treating wood with this preservative. The most simple method and one which has been found to give good results is the brush method, in which the hot product is applied with a brush. Telegraph poles, fence posts, cross arms and structural timbers have been successfully treated by this process.

The open tank is largely used where a large plant is not available. In this process the wood is immersed in the hot Timberasphalt at a temperature of 215 deg. F. and left for several hours. The air and water in the wood are expelltd by their expansion under the high temperature. The liquid is then allowed to cool to about 150 deg. F. and the contraction and atmospheric pressure cause the oil

to be forced into the wood. The Timber-asphalt may also be used under pressure.

The advantages claimed for the product may be given briefly as follows:

Its burning point is very high, about 365 deg. F..

It will not decompose under action of the elements.

It is practically non-volatile and inert, none of its value being lost by evaporation.

It is non-soluble in water.

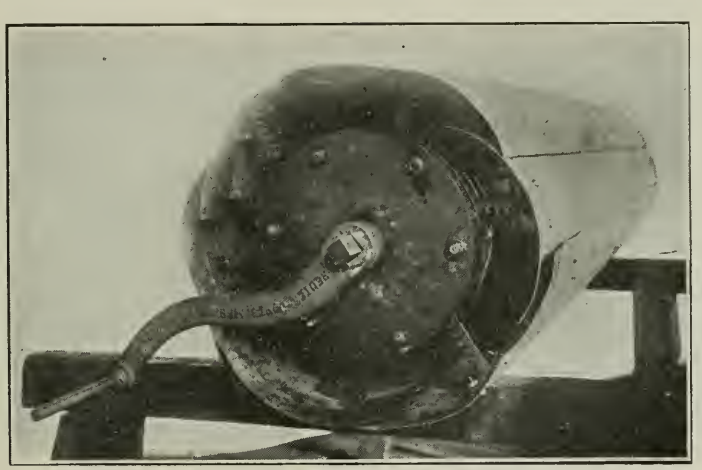
It has a low co-efficient of expansion.

It will not bleed from the timber after treatment.

It may be used as a substitute for paint.

It may be handled without physical injury to those who come into contact with it.

It may be applied either by brush, open tank or pressure method.



ADJUSTABLE CULVERT AND SEWER CENTER.

It may be applied in maximum quantities without excessive first cost.

Further information may be obtained from the Timber Treating Department of the Indian Refining Co., Cincinnati, O.

Wood Water Pipe.

The A. Wyckoff & Son Co. of Alexandria, La., have an unusually complete book describing their product, wood pipe. The introduction deals with the history of water pipe from the old hollow logs down to the present product. Next is a description of the plant at Alexandria, followed by a comparison and notes on the two kinds of wood, cypress and gum.

Following this division are a number of sections devoted to the Wyckoff pipe, its construction, advantages, laying, specifications, method of tapping and quotations of cost. The balance of the book is devoted to tables of friction loss in wood and cast iron pipe, and a partial list of users of Wyckoff pipe.

Free Construction of Good Roads.

The J. I. Case Threshing Machine Company of Racine, which is now largely engaged in the manufacture of road making machinery, has sent a letter to Town Chairman Joseph Bishop, of Somers, Wis., in which it offers to aid materially in completing the improvement of a road from the limits of the City of Kenosha through the entire east end of the town of Somers. It is the plan of the company to give the people of the two counties an object lesson in the use of road making machinery and to this end the company is ready to expend considerable money provided the town sees fit to aid the work. The cost to the town will be small in comparison with the work that is to be done and as the road between the two cities is one of the roads in the county most used by the farmers it is thought that the town board of Somers will see its way clear to accept the proposition. The plan for carrying out of the work is stated in the words of the letter offering the proposition as follows:

For the purpose of creating an object lesson in practical methods of modern road building, we have agreed to furnish to the town board of Mt. Pleasant the road building machinery, consisting of 10-ton road roller, engine, scrapers, etc.—together with a full complement of men to operate the same effectively—free of charge to the board, the only condition being that said board undertake to deliver and spread the necessary gravel to complete the work and supply the necessary culverts, etc., for drainage.

It is our desire to extend this work to the north city limits of the city of

Kenosha, through the township of Somers, provided a similar arrangement can be carried out with your honorable board. It is our understanding that the farmers of your township use this road extensively in marketing their produce and we would ask that our proposition be given your careful consideration.

The Gravity Carrier in Paving Work.

In the August number of MUNICIPAL ENGINEERING mention was made of a "home-made" device for handling brick upon street paving work. The Mathews Gravity Carrier Co., of Minneapolis, now has a carrier which goes a step farther in the economical handling of brick.

The photograph produced herewith shows the use of the carrier in delivering brick from the supply pile to the layer. The rollers shown are attached to the rigid frame at both ends and revolve upon ball bearings. For the purpose of guiding the brick and preventing their falling from the carrier, each roller is enlarged to a disk at the end, which is not an inch greater diameter than the roller.

MATHEWS GRAVITY PAVING BRICK CARRIER IN OPERATION.

The advantages of the carrier lie in the fact that the brick can be delivered just as needed, and that fewer men are required to handle them. Under the old system of wheeling them on the street or carrying them by hand, from 3 to 5 men were required. With the gravity carrier only two men at the most are needed.

In addition to the direct economy of delivery, there are several indirect advantages which will be at once appreciated by the person who is familiar with brick paving work. The brick are delivered directly to the place where they are required. They are not thrown into wheelbarrows and dumped upon the finished pavement to the more or less serious damage of their edges and corners. There is no tracking of mud upon the completed surface, requiring a cleaning of the surface before the cement filler can be used. Other advantages may arise due to local conditions, but those previously stated are true under all conditions. For catalogues and further information address The Mathews Gravity Carrier Co., Minneapolis, Minn.

Proper Coal Buying.

The determination of the exact heating value of solid or liquid fuel is the only logical basis upon which to buy such fuel. The larger cities have recently adopted specifications providing for full tests of all coal supplied for their use. It is only a question of time until the practice of demanding coal testing up to the required B. t. u. will supersede the habit of ordering "Pochahontas," or "Para," or "New River" coal; for it has been shown that in nearly every district producing high-grade coal there are occasional seams of the poorest variety.

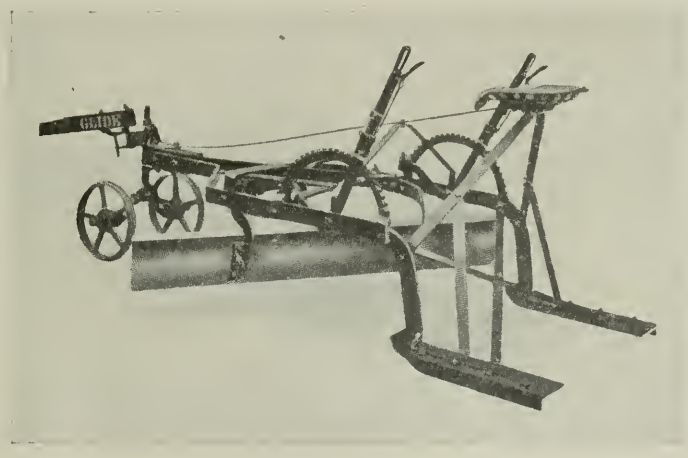
The Emerson Fuel Calorimeter, manufactured by Eimer & Amend, 205-211 Third ave., New York City, is designed for the thorough and accurate testing of the calorific value of fuels. The apparatus is of the bomb type and the method of its use is briefly noted as follows:

The sample for testing is carefully weighed and placed in a platinum pan suspended in the center of a steel bomb so constructed as to be made air tight. Connected to this pan are contact wires so arranged as to fire the combustible within, upon application of a current of electricity. After suspending the pan and its charge in place and closing the bomb, oxygen is admitted through a valve at the top until a pressure of 300 lbs. per square inch is obtained. The bomb is then immersed in the water within the calorimeter. The water in the calorimeter is kept constantly in motion by a special motor stirring device, from two to three minutes preceding the start of the test until its completion. With the bomb in place the

electric contact is closed, firing the fuel in the platinum pan. The rise in the temperature of the water is noted and the fuel value is deduced from the difference in temperature of the water produced by the combustion of a known quantity of the fuel. The test is simple in its application and its universal adoption will lead to conditions such that the buyer will pay for value received.

An Economical Road Leveler.

One of the great detriments to the advancement of the cause of good roads is the difficulty in getting labor and teams enough and at the proper time to carry on the needed work. It is difficult at any time to obtain help from the farmers, upon whom devolves the greater part of the road maintenance, and often the number of men procured is insufficeint to handle the more cumbersome machinery commonly used on such work.



THE GLIDE ROAD GRADER.

The Glide Road Machine Co. of Minneapolis, Minn., has recently put upon the market a machine which should revolutionize the method of maintaining earth roads. This machine is a two horse, one man, road leveler capable of doing the work of the old four horse scraper. This machine should be found of especial value for use on the outlying streets of cities; streets which in most cities are entirely neglected, making a more or less serious barrier between the pavements and the rural pikes.

The leveler consists of the common form of scraper blade mounted on a rigid framework in such a manner as to be raised 8 inches above ground when not in operation. Mounted upon this frame is a seat so arranged as to give stability and additional cutting power. To this frame is attached a strong tongue so forged as to prevent its sagging or swinging against the horses.

In the manner of supporting the machine is perhaps the most noteworthy feature. In the place of wheels, two flat steel shoes with outside flanges allow the machine to slip over the ground in a smooth path, without the added weight of wheels and axles. The sharp flanges entirely prevent any tendency towards sliding or skidding and assure a uniformity of surface usually very difficult of attainment. It may be used with equal facility over ditches or uneven ground. In addition to this use the machine will be found valuable in keeping up lanes, digging gutter ditches, keeping down weeds, etc. It is especially useful in cleaning walks and crossings of snow during the winter. For full information regarding this machine, address the Glide Road Machine Co., Minneapolis, Minn.

The Destructor Company.

The above is the title of a forty page book issued by the Power Specialty Company of 111 Broadway, New York City. The greater part of the book is given to the history, description and illustration of the Milwaukee refuse destructor. The tests and costs of operation are given with this division. The drawing the following wagon to enjoy waukee system are very complete in detail and serve to make clear the accompanying discussion. A photograph showing the garbage wagons used, is not altogether conclusive evidence of their being sanitary, for the covers are shown to be so warped as to allow the horse drawing the following wagan to enjoy a quiet little lunch from the wagon preceding.

The latter half of the book is devoted to the descriptions of the West New Brighton and Westmount Refuse De-

structors. The discussions are of the nature of reports rather than advertising literature and will be found of value in estimating the worth of the destructors noted.

"Pioneer" Filler Asphalt.

A small booklet dealing with "Pioneer" filler asphalt in use on paving work has been prepared by the American Asphaltum and Rubber Co., Chicago, Ill. Complete specifications for the filler and tests for attaining these specifications are given in the first pages. Following this are given the arguments for the type of filler advocated and a number of letters from city engineers and those who have used "Pioneer" filler. The latter part is given up to comparisons and methods of estimating quantities desired.

Ornamental Street Lighting.

In considering the problem of street lighting there is also that question of ornamentation which must be dealt with when it is considered that the supports or standards which support the lights and are comparatively unnoticed at night, will become the most noticeable feature of the street by day. Since the almost universal adoption of the cluster light system of street illumination, there have been a great many types of standards designed. These have varied from the severely plain standard, Quaker-like in its simplicity, to the very ornate designs, with frills and ornamentation effectually concealing the purpose for which the standard had been intended.

The standard shown in the accompanying photograph was designed and is manufactured by the Flour City Ornamental Iron Works, of Minneapolis. It is the happy medium between the two extremes just noted that seems to be coming into great popularity. The design, as will be noted, is consistent in every particular. The Corinthian standard, as it is named, is entirely Corinthian from the column and base to the four arms holding the globes. Every part, in addition to its beauty of design, is constructed with the idea of strength and solidity.

The standard is of the finest grade of cast iron, weighing 1,150 pounds. The base is set on a solid concrete block and attached to the block by means of 4 imbedded steel bolts. The globes are of hail proof opalescent glass, frosted on the inner side. Altogether, in addition to being one of the most artistic, it is also one of the most durable standards made.

Trade Publications.

The Milburn Light" is a booklet descriptive of various forms of acetylene lights manufactured by the Alexander Milburn Co., of 509 Lombard St., Baltimore, Md. Full description with illustrations of a number of types of the lamp are given, together with matter pointing out the adaptability and numerous uses of them. The company had a very interesting exhibit at the Good Roads Convention in St. Louis Sept. 28-30.

"Concrete in Highway Construction," a publication of the Atlas Portland Cement Co. that may be purchased by others than highway engineers at a cost of one dollar, was presented to all who inquired for it at the St. Louis Good Roads Convention. The book is of great practical value in its description and illustration by photographs and drawings of every possible use of concrete in road construction. The drawings of form construction, tables and descriptive matter are given in such detail as to be easily understood and followed.

Monthly Bulletin No. 77 of the Universal Portland Cement Co. contains a number of illustrated items of value. Several points of interest to the persons receiving shipments of cement, are given.

"The Wadsworth Macadam" is a booklet devoted to specifications, comments and tests relative to road construction by the use of Kentucky Rock Asphalt. The process is illustrated by photographs from the mining of the material to the stage of the finished road. The booklet may be obtained from The Wadsworth Stone and Paving Co., Pittsburg, Pa.

At the Good Roads Convention in St. Louis Sept. 28-30 the American Asphaltum and Rubber Co. had a very interesting exhibit of photographs and literature relative to their product. A copy of their booklet on road construction was given upon application. This booklet contains data on waterproof macadam road construction as well as complete specifications for the use of "Pioneer" road asphalt in such construction.

The Huber Manufacturing Co., of Marion, Ohio, have a folder descriptive of their combination traction engine and road roller.

"Yellow Pine Creosoted Blocks" is a complete discussion of the subject above mentioned, together with matter of value on the wood block paving question in general. It may be obtained from the Yellow Pine Manufacturer's Association, St. Louis, Mo.

"The Why of the Kelly-Springfield Roller" is a pamphlet treating of the uses and advantages of that piece of road machinery. Mention is made of booklets fully describing all the types manufactured by the company at their factory in Springfield, Ohio.

"Why a Pitch Filler" describes the reasons for using Barrett's Paving Pitch. The same company has issued a new engineer's handbook which will be mailed upon request.

"Furnace Slag" is a booklet issued by the Perry Iron Co., of Erie, Pa. The uses, weights, prices, etc., of the product

mentioned are fully discussed in a brief and complete manner. A number of testimonials are submitted with the booklet.

"The American Ditcher" is an unusually complete description of a ditching machine manufactured by the American Ditching Machine Co., of West Minneapolis, Minn., each point of the machine mentioned is illustrated by a small drawing set into the line of descriptive matter. Cost of operation is given.

The Standard Asphalt and Rubber Co. have a new dipping tank for applying Sarco mineral rubber pipe coating, a description will be sent on request.

The St. Mary's Sewer Pipe Co., St. Marys, Pa., has an illustrated catalogue with tables of weights, dimensions, prices, etc., of their pipe, specials and fire clay products.

Parmley System Reinforced Concrete is fully described in an illustrated booklet, showing actual construction and use of their system.

The T. L. Smith Concrete Equipment Company of Milwaukee, Wis., has a booklet for distribution, dealing with the various well known types of mixes which they handle. A supplementary leaflet descriptive of a new machine, a hand concrete mixer, which should meet with favor for use in sidewalk and other small work, is given out.

Trade Notes.

CEMENT.

Kansas City, Mo.—The Iowa stockholders, representing stock to the amount of $230,000, of the Lumbermen's Portland Cement Co., of this city, voted to accept the plans of W. E. Woods, president, for the reorganization of the company.

CONCRETE BLOCKS.

West Duluth, Minn.—W. K. Kilton, sidewalk contractor, has invented a concrete tie.

PURCHASE OF MACHINERY.

Chanute, Kas.—J. T. Rustamier, 601 W. 7th st., is in the market for some one-horse carts for handling stone and excavated material.

PURCHASE OF MATERIALS.

Boston, Mass.—Bids are asked until Nov. 12 for furnishing riprap for dike and breakwater at Princeton Harbor and Point Flats. Col. Frederic V. Abbot, Corps. Engrs., U. S. A.

MISCELLANEOUS.

New York City.—An important change in the management of the Goldschmidt Thermit Co., 90 West st., has been announced. Commencing with Oct. 1, E. Stutz, vice-president and general manager, retired from the direction of the company, which passed under the management of William C. Cuntz. Mr. Cuntz brings to his position a thorough knowledge of the steel business and a wide reputation with the railway and street railway officials of the country, having been connected for eighteen years with the Pennsylvania Steel Company.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Oconomowoc, Wis.—Paving is contemplated for Main st.

Clarion, Ia.—The question of paving the streets is being urged.

Lansing, Mich.—Brick repaving is contemplated for Washington ave.

Winona, Minn.—This city contemplates 1 mile of brick paving to cost $25,000.

Springfield, Ill.—Paving Jackson, Edward and Reynolds sts. is contemplated; $91,316.

Carthage, Mo.—A resolution has been passed providing for the graveling of Orner st.

Owatonna, Minn.—Will vote Nov. 8 on the issue of $30,000 paving and sewer bonds.

Boone, Ia.—About 14 blocks of brick paving is contemplated. K. C. Kastner, city engineer.

Waterloo, Ia.—Grading, curbing, guttering and paving is contemplated for 4th st.

Duluth, Minn.—The question of paving W. 3d st. from 20th to 29th aves. is being urged.

Winona, Minn.—About $20,000 will be expended for brick paving. Paul A. Jasmer, cy recdr.

Lake City, Minn.—The reconstruction of cement or concrete sidewalks is contemplated.

Spokane, Wash.—Plans and specifications have been approved for improving a number of streets.

Hastings, Minn.—A petition has been submitted to council asking that Hastings ave. be paved.

Coalina, Cal.—The city intends laying about 121,000 sq. ft. asphalt macadam. F. J. Borland, city engr.

Rising Star, Tex.—This town voted to issue $10,000 for street improvements and constructing sidewalks.

Springfield, Mo.—Resolutions have been passed for paving Lombard and Belmont aves. and N. Grant st.

Wetumpka, Ala.—It is stated that Elmore county will spend the $175,000 recently voted for good roads. E. W. Jones,

U. S. highway engr., recently made provisional survey for the proposed road.

Elkhart, Ind.—Paving is contemplated for 19 blocks in Oakland and California aves. A. M. Smith, city engr.

Cosmopolis, Wash.—This place is making plans for the laying of about 30,000 ft. of pavement the coming year.

Twin Falls, Idaho.—This place has voted bonds in the sum of $50,000 for street paving, fire apparatus, etc.

Dallas, Tex.—Resolutions have been adopted for paving Holmes st. and Grand ave. J. B. Winslett, city secy.

Rock Island, Ill.—Brick paving is contemplated for 13th ave. from 24th to 25th st., at a cost of about $5,820.

Carroll, Ia.—The city council has decided to construct 9 blocks of brick paving on concrete in the main business district.

Greenville, Ill.—It is reported that the city officals are considering the construction of concrete pavements on several streets.

Fond du Lac, Wis.—The Fond du Lac Land Co., S. D. Wyatt, anticipates building 12,000 ft. of concrete walk in North Fond du Lac.

Newark, N. J.—Ordinances have been passed for paving 13th ave. with asphalt and for grading, curbing and flagging Parkhurst st.

Cedar Falls, Ia.—The county board has decided to pave the bridge over Cedar river with creosoted blocks next spring.

Kenosha, Wis.—R. H. Moth, clerk, has plans under consideration for 4,927 sq. yds. of brick paving, concrete curb and gutter.

Gary, Ind.—T. E. Knotts, pres., city hall. Paving, curbs and sidewalks on 1st st., 1½ miles, cost $10,000, are contemplated.

Waterloo, Ia.—North Fourth st., Bridge st. and Commercial st, are to be paved with sheet asphalt with brick between the car tracks.

Crookston, Minn.—Council rejected all bids for paving and directed the city engineer to prepare plans for paving 3rd st. with asphalt.

Laporte, Ind.—The board of county commissioners contemplates the construction of 8 miles of the Van Kilkinson gravel road. Clyde Martin, Co. engr.

Toronto, Ont.—Paving is contemplated for Wellesley Lane, Grand View, Hampton, Strachan and Pacific aves., Dovercourt road, Sackville and St. Vincent sts.

Sioux City, Ia.—Council has decided to pave 9 streets with concrete during 1911. Corrugated concrete will be used on the highgrades.

East St. Louis, Ill.—Brick paving has been decided upon for 38th st. instead of creosoted wood blocks. Wm. J. Crooken, city engr.

Waco, Tex.—The residents and property owners in Exposition Park decided upon asphalt macadam for street paving at a meeting held Oct. 13.

Cadillac, Mich.—Council voted to adopt the plans, specifications and estimates for improving 1st ave. Most of the work will be done next spring.

Streator, Ill.—An ordinance has been passed providing for the construction of a concrete and cement sidewalk with stone curbing in Monroe st. P. J. Lucey, mayor.

Baker City, Ore.—Council has passed resolutions calling for bids for paving of North Main, Auburn, Resort, Bridge and 2d sts.; cement walk will be laid on 4th st.

Farmville, Va.—This city is considering expenditure of $30,000 in road improvements; material, bitulithic or vitrified brick; granolithic sidewalks and cement gutters on hillsides.

Kansas City, Mo.—Resolutions were adopted Oct. 11 for constructing artificial stone curbing and sidewalks, asphalt and rock asphalt paving in various streets, and concrete paving in certain alleys.

Cincinnati, O.—The county commissioners have ordered plans for improvement of River road at cost of $3,743, and for improvement of Mill road, from Totten's gate to Loveland and Madeira pike, at cost of $2,853.

Paducah, Ky.—This city will soon ask bids on construction of concrete sidewalks, curbs and gutters on Jefferson and 10th sts.; grading and graveling 14th st., and for construction of sidewalks on Flourney st. L. A. Washington, city engr.

Cincinnati, O.—Ordinances have been passed providing for paving and curbing Whiteman st.; constructing concrete supporting walls and reinforced concrete steps in Baymiller and N. Elm sts.; macadamizing, curbing and gutters in Probasco ave. John Galvin, prest. coun.

Munday, Tex.—This city voted to issue $5,000 bonds for street improvements.

Ashland, O.—The citizens have petitioned for brick paving, curbing and grading in Diamond Highway.

Portland, Ore.—The citizens of the state will vote in November on the issue of bonds for constructing roads.

Lancaster, O.—A resolution has been adopted authorizing the city engineer to prepare plans and specifications for paving Ewing st.

CONTRACTS TO BE LET.

Sullivan, Ind.—Until Nov. 9, for constructing a stone road. Ben. C. Crowder, co. audit.

Stanley, N. D.—Bids are asked until Nov. 5 for constructing several grades. W. C. Gibb, co. audt.

Logansport, Ind.—Until Nov. 15 for constructing a road. George W. Cann, so. audit.

Danville, Ind.—Until 10 a. m. Nov. 7, for constructing three roads. W. H. Nichols, co. audt.

Fowler, Ind.—Until 1 p. m., Nov. 7, for constructing four stone roads. Lemuel Shipman, co. audt.

Fernandina, Fla.—Bids are asked until Nov. 10 for paving Center st. with vitrified brick. G. L. Baltzell, cy. clk.

Rensselaer, Ind.—Until 12 m., Nov. 9, for constructing five stone road improvements. James N. Leatherman, co. audt.

Vernon, Ind.—Until 11 a. m., Nov. 7, for constructing 2½ miles of pike road in Bigger township. T. L. Thomas, co. audt.

Ft. Wayne, Ind.—Until 10 a. m., Nov. 12, for improvement of highways in Maumee township. George W. Lindesmith, co. audt.

Olympia, Wash.—Until 2 p. m., Nov. 2, for grading, draining and macadamizing State Aid work No. 54. Henry L. Bowlby, secy. highy. bd.

Seattle, Wash.—Until 11 a. m., Nov. 5, for constructing roads, walks, drains, crossings, etc., at Ft. Ward. Capt. C. Long, contn. qm.

Crowley, La.—Bids are asked until 8 p. m., Nov. 23, for constructing 33,000 sq. ft. of 6 in. concrete street crossings. T. J. Boudreaux, cy. clk.

Brooklyn, N. Y.—Bids are asked until Nov. 2 for repaving 4,430 sq. yds. of E. 8th st. with asphalt concrete on macadam base. Alfred E. Steers, pres. boro.

Newark, N. J.—Bids are asked until 10 a. m., Nov. 10, for grading and paving

with telford, the following streets: Gregory ave., 8,846 ft. in the town of West Orange; Union ave., 6,133 ft., from Belleville twp. to town of Nutley; Green Brook road, 1,333 ft. of macadam coating, from Caldwell twp. to North Caldwell. Com. on roads and assmts., bd. chosen freeholders.

Huntington, W. Va.—Until 1 p. m., Nov. 14, for paving three alleys with vitrified brick. John Coon, comr. sts.; A. B. Maupin, cy. engr.

Hallock, Minn.—Until 1 p. m., Nov. 1, for constructing state roads Nos. 2 and 3, involving 37,250 sq. yds. earth and 8 20x34 concrete culverts. C. J. Hemmingson, co. audt.

Oakley, O.—Sealed bids are asked until 12 m., Nov. 1, for constructing cement sidewalks in Follet, Carpenter and Dawson aves. and Kline and Addie sts. Oscar Kosche, vil. clk.

Dubuque, Ia.—Until Nov. 6, for constructing 5,028 sq. yds. telford macadam paving, and 2,672 lin. ft. combined cement curb and gutter in Delphi st. (Private plans.) Otto P. Gieger.

Newark, N. J.—Bids are asked until Nov. 10 for paving 14,979 ft. of Gregory and Union aves. with telford macadam and coating 13,334 ft. of Green Brook road with macadam. Wallace Ougheltree, dir. freeholders.

Rushville, Ind.—Until 2 p. m., Nov. 10, Jesse M. Stone, audt., court house. Gravel roads in Posey and Ripley townships and macadam roads in Noble, Anderson and between Ripley and Posey townships; bonds required.

Trenton, N. J.—Until 10 a. m., Nov. 10, for telford paving in Gregory and Union aves. and macadam in Green Brook road. Wallace Ougheltree, dir. committee on roads and assessments of board of freeholders.

Chicago, Ill.—Sealed bids are asked until 11 a. m., Nov. 2, for paving Ogden ave. with No. 2 granite blocks, from Western ave. to present brick pavement in Ogden ave. ($100 cash or certified check.) B. J. Mullaney, comr. pub. wks.

Jacksonville, Fla.—Until 9:30 a. m., Nov. 1, for grading, curbing and paving 25 miles of hardsurfaced county roads, with brick, concrete, asphalt macadam, bitulithic, or other material. F. J. Hyde, chrm. co. comrs.

Columbus, O.—Until Nov. 1 for grading and macadamizing 2 miles road in Preble county; until Nov. 2 for 2.59 miles in Lucas county; until Nov. 9 for 1 mile brick paving in Geauga county; until Nov. 9 for 1.09 miles brick paving in Noble county. James C. Wonders, state highway comr.

Cincinnati, O.—Bids are asked until Nov. 18 for constructing county road work. Fred Dreihs, clk. co. comrs.

Westfield, N. J.—Bids are asked until 8:15 p. m., Nov. 7, for improving certain streets with macadam, concrete curb and gutter, etc. Lloyd Thompson, town clk.

Cincinnati, O.—Bids are asked until Nov. 4 for paving Pogue ave. with brick, with limestone curbs and drains and inlets. John J. Wenner, clk. bd. pub. ser.

Shelbyville, Ind.—Bids are asked until 7:30 p. m., Nov. 1, for constructing sidewalks, gutters, etc., in several streets. L. E. Webb, cy. clk.

New Orleans, La.—Bids are asked until Nov. 18 for constructing roads and walks at Jackson Barracks, La. Geo. B. Davis, acting Q. M., 416 Hibernia Bank Bldg.

Sedalia, Mo.—Bids are asked until 5 p. m., Nov. 7, for constructing concrete curbing in Osage ave. C. E. Baker, cy. clk.

CONTRACTS AWARDED.

Memphis, Tenn.—The contract for paving McLemore ave. with asphalt was awarded to the Barber Asphalt Paving Co., of Chicago.

Hastings, Neb.—The contract for brick paving was awarded to O. C. Chapin, at $2.04 a sq. yd.

Pekin, Ill.—Jansen & Zoller, of this city, secured the contract for paving 3 sts., for $14,000.

Lafayette, Ind.—The contract for constructing the Brown gravel road was awarded to D. H. Fatout, for $3,925.

Springfield, Mo.—The contract for paving State st. with brick was awarded to J. C. Likes, at $2.14 a sq. yd.

Tarkio, Mo.—The contract for paving Main st. was awarded to Wellman & Olson, of St. Joseph, for $25,000.

Ottawa, Ill.—The contract for paving Chartres street was awarded, Oct. 12, to Keys & McNamara, for $18,033.50.

Peoria, Ill.—A. D. Thompson has the contract for paving Garfield ave., $7,320.

Coffeyville, Kan.—Contract for paving awarded to McGuire & Stanton, of Leavenworth, Kan., $20,000.

Lexington, Ky.—Macadam roads on Park and Woodland aves. awarded to C. C. Miller & Co.

Granby, Conn.—The board of selectmen of this town has been awarded contracts for paving two sections of road.

Chicago Heights, Ill.—About 18,000 sq. yds. brick paving awarded to Chicago Heights Coal Co., $49,641.

Stamford, Conn.—L. F. Merritt was awarded the contract for building 2,305 lin. ft. macadam-telford road.

Mansfield, Conn.—Tony Leo was awarded a contract for constructing 6,475 lin. ft. of gravel-telford road.

Eldora, Ia.—Dearborn & Jackson Co., of Cedar Rapids, have been awarded the paving work in this city.

Brownville, Pa.—The contract for paving the State road with brick was awarded to Wm. C. McCormick for $7,080.

Hoquiam, Wash.—The contract for improving Fillmore st. was awarded to the Aberdeen Construction Co., of Aberdeen, for $1,380.

Kansas City, Mo.—The Jaicks Asphalt Co. of Chicago, was awarded a contract for paving 8th st. with asphalt, at $1.76 a sq. yd.

Olathe, Kas.—The contract for constructing 4½ miles of rock road was awarded to Ransom & Cook, of Ottumwa, Kas., for $30,456.

Elyria, Ill.—The McCarthy Improvement Co., of Davenport, Ia., was awarded the contract for paving N. Spring st. with mineral rubber, for $52,500.

Tarpon Springs, Fla.—The contract for paving with vitrified brick was awarded to the Chattanooga Paving Co., of Chattanooga, Tenn., for $45,000.

Cumberland, Md.—Frederick Perry was awarded a contract for repaving Union, East Center and Harrison sts, for $9,351.

Jackson, Tenn.—The city council adopted bitulithic material for paving and awarded the contract to the Southern Bitulithic Co., of Nashville, at $58,000.

Parkersburg, W. Va.—J. W. Curry was awarded a contract for grading 3,000 ft. of road near Redwood, at 24½ cents a cu. yd.

East St. Louis, Ill.—Paving contracts were awarded, Oct. 20, as follows: Paving alley between 12th and 13th sts. and College ave. and State st., $4,688 and improving rock road from 9th to 19th sts., $2,917, Meyer Construction Co., St. Louis; improving Brady ave., C. A. Horn, of East

St. Louis, $21,923; Kansas ave., Gaynard & Sweeney, of East St. Louis, $7,832.72.

Portland, Ore.—Contracts for street improvements have been awarded as follows: Grading and conc. curbs, Elwood Wiles, Beck Bldg.; Peninsula Feed & Fuel Co., 769 Dawson st.; R. J. Debuhr, 711½ Williams ave.; Joplin & Meeks, B. of T. Bldg. Pavements: Warren Const. Co., Beck Bldg.; Oregon Hassam Paving Co., 805 B. of T. Bldg.

Seattle, Wash.—Street improvement contracts have been awarded as follows: Andrew Peterson, Pioneer Bldg.; for the grading of Rainier ave., at $34,802.50; Rufus Buck, 414 Central Bldg.; for the planking of Rainier ave., at $5,803; Agassiz & Hadley, 1212 Western ave., for the grading of alley in blk. 30, at $1,184; The Barber Asphalt Co., Henry Bldg.; for the paving of E. John st., at $2,672.20. Bids were rejected on the following work: For the paving of an alley in blk. 9, Capitol Hill add.; for the paving of alley in blk. 17 Boren's add.

Midvale, Utah.—The contract for paving the sidewalks was awarded to James Wood, of Murray, Utah, for about $5,000.

Erie, Pa.—C. T. Eastburn, of Yardley, Pa., was awarded the contract for experimental pavement in West Lake road, for $6,307.

Newington, Conn.—The contract for constructing 3,737.7 lin. ft. macadam-telford road was awarded to Thos. Kearney, of Minden, Conn.

Streator, Ill.—Contracts were awarded Oct. 10 as follows: Paving W. Bridge street with brick John Baer, $1.25; S. Vermillion st., George Swartz, $1.39 a sq. yd.

Des Moines, Ia.—The Bryant-Ford-McLaughlin Asphalt Paving Company has been awarded a contract for paving and constructing 37th st.

Weston, Conn.—The contract for constructing 2,600 lin. ft. of gravel-telford road was awarded to L. F. Merritt, of Stamford, Conn.

Cairo, Ill.—L. W. Johnson, of Danville, Ill., has the contract for paving Commercial ave., 59,975 sq. yds. brick pavement, ets., $110,553.

Kenosha, Wis.—A contract for constructing 1 mile of paving was awarded to John O. Jones, of Racine, for about $40,000.

Omaha, Neb.—The contract for grading the Southeast boulevard near Montanello Park was awarded to the Krautz-Turner Co. for $10,000.

Middletown, Ill.—The contract for constructing 26,000 sq. ft. of cement sidewalk was awarded to Harvey K. Rhoades, of Lincoln.

Voluntown, Conn.—The Eldredge Construction Co. of Mystic, Conn., was awarded two contracts for gravel-telford road, for $3,915.

Redding, Conn.—Contracts for constructing 5,575 lin. ft. of gravel-telford road have been awarded H. Sanford Osborn and Herbert S. Barnes, aggregating a total of $4,125.

Lockland, O.—The Kirchner Construction Co., 8th and Plum streets, Cincinnati, has been awarded a contract for paving Wayne ave. with vitrified brick, for $32,000.

Newark, N. Y.—The contract for constructing 2 miles of curbing in West Miller street has been awarded to Hagaman, Miller & Hagaman, of Rochester, for $10,000.

Harrisonville, N. J.—Harry Clark, of Delaware City, Del., was awarded a contract for building a government road from Ft. Watt to this city, for $10,000.

Oakmont, Pa.—The contract for 1,000 sq. yds. of paving, 451 lin. ft. curb and gutter, and 384 cu. yds. of grading was awarded to James Topley & Co., of McKeesport..

Regina, Sask.—This city has recently awarded a contract for 21,900 sq. yds. of bitulithic pavement to the Bitulithic & Constructing Co., Ltd., of Winnipeg, Man.

Woodburn, Ore.—The Warren Construction Company, of Portland, Ore., has recently been awarded additional contract for 3,000 yards of bitulithic pavement here.

Atlantic City, N. J.—The United Paving Company of Atlantic City has been awarded a contract for resurfacing approximately 22,000 sq. yds. of Meadow blvd. in Atlantic County, N. J., with warrenite.

East St. Louis, Ill.—The M. L. Harris Co. was awarded contracts for 15,046 sq. yds. of creosoted wood block paving and 9,503 lin. ft. of granitoid curbing in Vogel Place, Alhambra court, and 36th st., for about $42,000.

Providence R. I.—Alton A. Allen was awarded a contract for constructing macadam driveways and other improvements in North Park lands, for $15,392.

Baker City, Ore.—The contract for paving Bridge, Auburn, Resort, N. Main and 2nd sts. with bitulithic was awarded to the Warren Construction Company, at $2.25 a sq. yd.

Boston, Mass.—The Massachusetts highway comr. has just awarded a contract for the construction of a state highway in Rockport to T. L. Thompson, of Boston, for $4,906.

Des Moines, Ia.—The Bryant-Ford-McLaughlin Asphalt Paving Company was awarded a contract for paving and curbing 37th st. with asphalt.

Denver, Col.—The Gaffy & Keefe Construction Co. has been awarded a contract for street, curbing and sidewalk improvements in South Denver district No. 8, for $52,925.

Hermosa Beach, Cal.—The Barber Asphalt Paving Co., Henne Bldg., Los Angeles, was awarded a contract for constructing 2 miles of roadway, for $65,000.

Peoria, Ill.—Brewster & Evans secured the contract, Oct. 12, for paving North and South Adams streets from Hamilton to Bridge sts, with creosoted wood blocks, for $34,491.50.

Portland, Ore.—Contracts for street paving, aggregating $295,813 have been awarded the Independent Paving Company, Hassam Paving Company and the When Paving Company.

Portsmouth, O.—Samuel L. Rice has been awarded a contract for paving Sinton st. from Front to Gallia sts., with brick on a concrete base, with tar filler, for $5,131.

Memphis, Tenn.—The Barber Asphalt Co., of Chicago, was awarded the contract for paving McLemore ave. with asphalt, and immediately sublet the work to the Memphis Asphalt Co.

Mays Landing, N. J.—A contract for resurfacing witah Warrenite about 22,000 sq. yds. of the Meadow blvd. in Atlantic county has been awarded to the United Paving Co., of Atlantic City, N. J.

Albert Lea, Minn.—Fielding & Shepley, of St. Paul, secured the contract for paving Adams, Broadway, Water and Washington sts., aggregating 16,440 sq. yds., with wooden blocks, for $34,986.

Tacoma, Wash.—Paving contracts have been awarded as follows: Third st., McAdam & Co., $82,027; 15th ave., W., and Thorndike st., J. A. Zinkoin, $6,228; grading and curbing 14th ave., DeFlong &

Co., $988; concrete walks in Whitman ave. et al., Packard-Spink Co., $25,798.

Seattle, Wash.—Paving contracts were awarded, Oct. 11, as follows: Resurfacing, curbing and concrete walks in 17th ave., N., Peabody Bros., $9,850.82; brick paving and granite curbing, 3rd ave., Grant Smith & Co. and Stillwell, $81,006.20; concrete walks in Whitman ave., Packard-Spink Co., $25,768.90.

Pittsburg, Pa.—Contracts for improving roads were awarded Oct. 10, as follows: Monongahela river road, Ridge Bros., 407 4th ave., $10,486; Butler road, Ott Bros. Co., 414 Washington ave., $21,416; Brighton road, M. O'Herron Co., S. First and McKean sts., $5,691.

Bloomfield, Ind.—Contracts for constructing gravel roads have been awarded as follows: Elliott road to Frank Musselman, of Newberry, $4,605; Clayton road, Fred Carpenter and R. M. Stafford, of Lyon, $4,600; Dayhoff road, Samuel Hays, of Worthington, $5,298.

Alexandria, La.—Gailey & Clark was awarded a contract for paving Gould and Jackson aves. and Beauregard st. Gould ave. will be paved with vitrified brick for a distance of four blocks at $2.85 a sq. yd. and the remainder to the city limits with gravel, at 95 cents a sq. yd. Jackson ave. and Beauregard st. will be paved with vitrified brick at $2.75 a sq. yd.

McKees Rocks, Pa.—Paving contracts have been awarded as follows: Grading, curbing and paving School, Olivia, Guthrie and Robinson sts., M. O'Herron & Co., S. First and McKean sts., Pittsburg, Pa.; Gardiner and Page sts., Frank Bryan, 1259 Chartiers st., Pittsburg; constructing 10,000 lin. ft. cement sidewalks, 2,000 cu. yds. grading and 500 sq. yds. filling, W. F. Herschberger. Total cost $25,000.

Cincinnati, O.—B. Niehaus was awarded a contract for improving Lawrenceburg and Elizabethtown pike for $18,585. Other contracts have also been awarded as follows: Race ave., in Green township, N. Reubel, $4,522; improvement of Gurley road, Green township, N. Reubel, $8,554; South ave. and Werk road, J. Nickolson $7,750; Walton Creek road, R. S. Flynn, $1,437.

Montgomery, Ala.—Contracts have been awarded as follows: Bitulithic paving, Madison ave., Southern Bitulithic Paving Co.; Catoma and other streets, Barber Asphalt Pacing Co. The awards have been protested by the property owners.

Witchita, Kas.—A contract for paving two miles of E. Second st. was awarded to Rackliffe & Gibson, for about $85,000. Other paving contracts awarded are as follows: W. Douglas ave., Cleveland Trinidad Paving Co., $2.59 a sq. yd.; right-of-way of street car tracks in Central ave., W. G. McKee, $2.49; Wiley ave., Stuckey Construction Co., $1.99; Maple st., Nolan & Draper, $1.97; Erie st., Stuckey Construction Co., $1.99.

Seattle, Wash.—Hans Pederson, Alaska bldg., was awarded the contract for paving University st., at $29,648. De Fong & Co., 917 22nd ave., was awarded the contract for walks on E. 76th st. at $4,847; H. Dahlstrom, 2437 W. 56th st. for the installation of sewers on W. 57th st.; Hansen & Co., 4100 25th ave. S. W., awarded the contract for the construction of pile bridge on Whatcom ave., at $5,327.

Springfield, Mo.—Contracts have been awarded as follows: Brick paving in State st., J. C. Sikes, $2.14 a sq. yd.; Hassam paving, alley, Rackliffe-Gibson Construction Co.; concrete curbing and guttering, E. Walnut st., Will F. Plummer, 47½ cents a lin. ft.; cement sidewalks in Prospect ave., Nichols D'Onfro, 44 cents a lin. ft. for walks and 23 cents a cu. yd. for grading; concrete curbing in State st., J. Underwood, 38 cents a lin. ft.; cement sidewalks in Rogers ave., and concrete curbing in Center st., H. Proserpi.

Portland, Ore.—The Warren Construction Company, of Portland, has been awarded contracts for paving with bitulithic aggregating 80,000 sq. yds. in this city. .The Pacific Bridge Company, of Portland, has also been awarded contracts for paving 15,000 sq. yards of streets with bitulithic.

Seattle, Wash.—Contracts for street improvement have been awarded as follows: Planking Olive st., Wm. Kopka, city, $9,496;; concrete walks, Whitman ave., Packard Spring Co., city, $25,768; brick paving and granite curbing, 3rd ave., Grant Smith & Co. and Stillwell, city, $81,000.

Harrisburg, Pa.—Bids were submitted, Oct. 13, for 79,853 sq. yds. of paving and 67,099 lin. ft. of curbing as follows: Barber Asphalt Co., for California or Pioneer sheet asphalt, $1.43 to $1.65 per sq. yd. and for curb 70 to 73 cents per lin. ft. for granite, 41½ cents per ft. for steel-bound granolithic or 30 cents for granolithic. The Central Construction and Supply Co. bid for Trinidad Lake sheet asphalt $1.42 to $1.98 per sq. yd. and for curb 74 to 90 cents per lin. ft. for granite, 40 to 65 cents for steel-bound granolithic or 30 to 45 cents for granolithic.

New York City—Bids were submitted, Oct. 15, for paving in Bronxboro as follows: Wlkins ave., from Intervale ave. to Southern blvd., lowest bidder, Hastings Pavement Co., as follows: 3,430 sq. yd. completed asphalt block pavement, and keep same in repair for 5 years from date of acceptance, $1.75; 498 cu. yd. concrete including mortar bed, $5.92; 200 lin. ft. new curb, furnished and set in concrete, $1; 850 lin. ft. old curbstone, rejointed, recut on top and reset in concrete, 33 cents.; total, $9,363. The Barber Asphalt Co. bid for this work, $9,797. E. 135th st., from Southern blvd. to Locust ave.: Lowest bidder, Hasting Pavement Co., 6,735 sq. yd. completed asphalt block pavement and keep same in repair for 5 years, $1,63; 1,080 cu. yd. concrete, including mortar bed, $5.92; 800 lin. ft. new curb, 98 cents; 3,100 lin. ft. old curb, reset in concrete, 33 cents; total, $19,179. The Barber Asphalt Co. bid for this work $21,161. The Hastings Pavement Co. was also lowest bidder on paving E. 172d st., from 3rd to Park ave., with asphalt block on concrete foundation at $7,002. Walton ave., from Fordham road to Burnside ave. Lowest bidder, Uvalde Asphalt Paving Co., as follows: 12,230 sq. yd. bituminous macadam pavement and keep same in repair for 5 years, $1.25; 2,200 lin. ft. curb adjusted and new curb where required, 25 cents.; total, $15,837. Other bidders: Barber Asphalt Paving Co., $16,769.30; Asphalt Construction Co., $16,119. W. 165th st., from Anderson ave to Lin ave. Lowest bider, Atlanta Construction Co. 2,600 sq. yd. new granite block pavement on sand foundation, laid with cement grout joints, and keep same in repair for 1 year, $2.54; 600 lin. ft. new curb, 70 cents; 1,350 lin. ft. old curb, reset, 23 cents; 150 sq. ft. new bridgestone for crosswalks, 50 cents; 1,250 sq. ft. old bridgestone, relaid, 10 cents; total, $7,534. Totals of other bids: L. J. Moran, $8,224; M. Baird Construction Co., $8,418; Asphalt Construction Co., $8,397, and J. Farrell, $8,333.

SEWERS.

CONTEMPLATED WORK.

Deming, N. Mex.—A sewerage system is contemplated.

Barrington, Ill.—A sewer system to cost $59,000 is planned by this city.

Healdsburg, Cal.—The construction of a sewerage system is contemplated.

Toledo, O.—The construction of a sewerage system next year is contemplated.

Owatonna, Minn.—Will vote Nov. 8 on the issue of $30,000 sewer and paving bonds.

Niles, O.—The construction of sewers in Park and Hartzell aves. is contemplated.

Winsted, Conn.—This city voted to install a sewerage system. Borough warden.

Winfield, N. Y.—The citizens intend to build a $10,000 private sewer system.

Arkadelphia, Ark.—Council has decided to construct sewer system; cost about $35,000.

Alton, Ill.—Estimates have been prepared for constructing sewer in Danforth st.

Wooster, O.—The sum of $38,000 is asked for a new water supply at Bloomington reservoir.

Pecos, Tex.—Will vote on the issue of $25,000 bonds for constructing a sewerage system.

Westernport, Md.—Bonds for $75,000 water works and $10,000 sewer system have been issued.

Carthage, O.—Bids for a sewer system, to cost about $50,000, will be asked inside of 15 days.

Port Jefferson (L. I.), N. Y.—The question of installing a sewerage system is under consideration.

Gilbert, Minn.—Plans are being prepared for constructing a sewerage system.

Gilbert, Minn.—The citizens have voted $20,000 bonds to install sewerage system.

Sallisaw, Okla.—The citizens have voted $45,000 bonds for sewers. A. W. Bates, engr.

Pittsburg, Kas.—A resolution has been passed to build sewers in various streets. C. B. Hoyt, mayor.

Springfield, O.—The construction of sewers in various streets is contemplated. C. J. Bowles, mayor.

Topeka, Kas.—Petitions are being circulated for constructing sewers in all the districts not now drained.

Belle Plain, Ia.—Civil Engr. Hart, of Clinton, is preparing plans and estimates for a sanitary sewer system.

Grosse Pointe Park, Mich.—Plans will be prepared for constructing a sewerage system. Vil. trustees.

Rockville Centre (L. I.), N. Y.—The question of constructing a sewerage system is being discussed.

Kokomo, Ind.—J. H. Watson, city engr. Sanitary sewer 2,400 ft. vitrified 15-in. pipe on Tyner st. is contemplated.

Opelousas, La.—The city board of health has recommended the establishment of sewerage system for this city.

Louisville, Ky.—The city board of health has indorsed the $100,000 bond issue for the extension of the sewerage system.

Yorkville, N. Y.—The citizens voted, Oct. 15, to issue bonds for a sewerage system. Plans have been prepared.

Easton, Md.—Plans for sewers and sewage disposal works will be made by Clyde Potts, 30 Church st., New York City.

Hubbard, O.—The village council enacted the first legislation, Oct. 17, towards the establishment of a sewerage system.

Austin, Minn.—The city is planning sewer extensions on various streets to cost about $1,500. Frank Cronin, recdr, city hall.

Wilmington, O.—The construction of a drainage and sewerage system is contemplated at a cost of about $90,000.

Bloomington, Ill.—Bids will be asked within a short time for Clay st. and Willard ave. sewers and McClan-Taylor st. water main.

Aberdeen, S. D.—Plans have been prepared by the city engineer for the construction of a sewer system. Estimated cost, $75,000.

Mason City, Ia.—The city will consider a resolution Oct. 17 for the construction of 650 ft. of 10-in. and 580 ft. of 8-in. sewer.

Pittsburg, Kan.—A $50,000 sewerage system and septic tank disposal plant is planned. Prof. W. C. Hoad, of the State University, engr.

Muskogee, Okla.—The city is planning a large sanitary intercepting sewer, for which City Engr. Clonts is making surveys and plans.

Bozeman, Mont.—Council has decided to construct portion of District Sewer No. 31 at cost of $2,893.75. A. M. Brandenburg, cy. clk.

Reading, O.—Plans and estimates for constructing a complete sanitary sewerage system will be prepared by Village Engr. Hosbrook.

Stockton, Cal.—The city engineer has prepared plans for construction a 6-ft. outfall sewer in Harrison, Market and Washington sts.

Little Rock, Ark.—The board of public affairs has decided to advertise for bids for construction of storm sewer in Main st. Frank Olive, secy.

Terrell, Tex.—Will vote Nov. 10 on the issue of bonds for constructing sewers and other improvements at the Central high school building.

Mobile, Ala.—Plans are being prepared for extending the sewerage and water systems. Wright Smith, chief engr., bd. pub. wks.

East Orange, N. J.—Representatives of Orange, Montclair, Glen Ridge and Bloomfield met here, Oct. 13, to discuss the question of building a joint sewer.

West Morgantown, O.—The West Morgantown Sanitary Water and Sewer Co. has been capitalized at $10,000 to construct sewer and water lines for the city.

Winterset, Ia.—Consulting Engrs., W. K. Palmer & Co., Kansas City, Mo., has prepared plans for 3 miles of sanitary sewer, septic and flush tanks. Cost $115,000.

Roseville, Cal.—This city has sold $78,500 bonds to be used for construction of a sewer system. J. H. Stineman, cy. clk.; U. S. Marshall, engr.

Allentown, Pa.—A committee of 15 has been appointed, with Col. Harry C. Trexler, chrm., to devise a plan for constructing a sewerage system.

Wilmington, Del.—An ordinance has been passed by the city council appropriating $30,000 for the construction of trunk sewers in the Ninth ward. Alexander J. Taylor, cy. engr.

Pottstown, Pa.—The state health commissioner has asked Burgess Charles Brooke to take some definite step by Nov. 1 for providing this town with a sewerage system and disposal plant.

Port Jefferson (L. I.), N. Y.—The installation of a sewerage system is contemplated, and a committee has been appointed to circulate a petition among the property owners.

Grand Island, Neb.—The State has appropriated $10,000 toward the construction of a sewer 1,000 ft. of which will be

in State land. The city will add $8,000 to this sum as their share of the expense. Bids will be asked soon.

Winsted, Conn.—Winslow Goodwin is chrm. of a committee appointed to secure a sewerage system. An expenditure of $5,000 has been recommended for preliminary engineering work and expert advice.

East Moline, Ill.—The Board of Local Improvements has decided to accept estimate furnished by Cy. Engr. H. G. Paddock on proposed extension of the sewer system; estimated cost $50,000; length 7 miles.

Los Angeles, Cal.—The residents and property owners in San Pedro have petitioned the city council to construct a storm sewer system for the protection of the business district of that part of Greater Los Angeles.

Rock Island, Ill.—An ordinance has been passed providing for the construction of a sewerage system south of the railroad tracks. Plans and specifications for approximately 7 miles of sewer have been prepared by Cy. Engr. Paddock.

Marcus Hook, Pa.—An ordinance has been passed for constructing a sewer in E. 9th st. R. L. Elliott, prest. coun.

Rochester, N. Y.—A public hearing was held Oct. 19 on the ordinance appropriating $500,000 for the purpose of constructing intercepting sewers, as a part of the proposed plan for sewage disposal and to avoid pollution of the lower river.

Newberg, Ore.—Voted, Oct. 4, to install a sewerage system.

Laramie, Wyo.—Will vote in November on the issue of $15,000 for improving the sewer system.

Lancaster, O.—The city engineer has been directed to prepare plans and specifications for constructing sewers in Frederick st. and the William Cox addition.

North Vancouver, B. C.—George S. Hanes, city engineer, advises us that this city is just beginning an entirely new sanitary sewerage system. The Provincial board of health has passed upon the plans.

CONTRACTS TO BE LET.

Jonesboro, Ark.—Until Nov. 5 for constructing a drainage canal. J. H. Burk, cy. engr.

Roseville, Cal.—Until Nov. 7 for constructing a complete sewer system. J. H. Stineman, cy. clrk.

Prosser, Wash.—Until 5 p. m., Nov. 1, for constructing a sewerage system. E. A. Coffman, cy. clk.

Carthage, O.—Until Nov. 8 for constructing an entire sanitary sewerage system. Lewis Hall, vil. clk.

Jermyn, Pa.—Until Nov. 7 for constructing a 10-in. sewer in Franklin st. John A. Loughney, secy council.

Bellefontaine, O.—Until Nov. 1 (change of date) for constructing sections 1 and 2 of sanitary sewer system. C. A. Guskeep, cy. engr.

Atlantic City, N. J.—Until 8 p. m., Nov. 14, for constructing a storm water drainage system in various streets. E. D. Rightmire, cy. engr.

South Milwaukee, Wis.—Nov. 1, J. H. O'Connell, clk. Sewer extension and purification plant, $25,000. Alvord & Burdick, Chicago, engrs.

Carthage, O.—Bids are asked until Nov. 8 for constructing a sanitary sewerage system. Lewis Hall, vil. vlk.

Cleveland, O.—Bids are asked until 12 m. Nov. 3 for constructing a drainage sewer. A. B. Lea, dir. pub. service.

Ft. Caswell, N. C.—Bids are asked until Nov. 18 for constructing sewers and cisterns here. Lieut. R. O. Edwards, constr. Q. M.

Mitchell, S. D.—Bids are asked until 1 p. m. Nov. 7 for constructing lateral sewers, consisting of branches. L. L. Ness, cy. audt.

Shelbyville, Ind.—Bids are asked until 7:30 p. m., Nov. 1, for constructing a sanitary trunk sewer system. L. E. Webb, cy. clk.

Atlantic City, N. J.—Bids are asked until 8 p. m., Nov. 14, for constructing a storm water drainage system. E. D. Rightmire, cy. engr.

Baltimore, Md.—Bids are asked until Nov. 2 for constructing lateral sewers in District 34A, sanitary contract No. 57. J. Sewell Thomas, cy. rgr.

Chicago, Ill.—Bids are asked until Nov. 2 for constructing tile pipe and brick sewers in a number of streets. Albert F. Keeney, prest. bd. local impvts.

Richmond, Ind.—Bids are asked until Nov. 10, for constructing 950 ft. of 24-in. pipe sewer. F. R. Charles, cy. engr.

Lincoln, Neb.—Bids are asked until 12 m., Nov. 7, for constructing a number of sewers, with pipe branches, manholes, etc. L. L. Ness, cy. audt.

Ft. Dodge, Ia.—Bids are asked until 2:30 p. m., Nov. 18, for constructing a ditch and drain in dist. No. 79, Washington twp. J. L. Hanrahan, co. audt.

Cleveland, O.—Bids are asked until 12 m., Nov. 3, for constructing a drainage sewer around the city hall site. Edward A. Roberts, clk. City Hall Com.

St. Paul, Minn.—Bids are asked until 2 p. m., Nov. 3, for constructing sewers in Dayton ave., Bradley, Geranium, Conway and other streets. R. L. Gorman, clk. B. P. W.

CONTRACTS AWARDED.

Harrisburg, Pa.—Charles Fisher was awarded a contract for constructing the Park st. sewer, for $6,960.

Frankfort, S. D.—Jones & Roderick, of Sioux Falls, secured a contract for sewer work here for $8,915.

Grand Island, Neb.—H. J. Cathroe, of Omaha, was awarded a contract for constructing sewers, for $12,100.

Eagle Grove, Ia.—The contract for sewer construction was awarded to C. Anderson & Co., of Vincent, for $10,290.

Oakland, Cal.—J. F. Greanel was awarded a contract for constructing a sewer in Market and 7th sts., for $5,550.

Pasadena, Cal.—U. R. Nichcevitch, 2824 7th ave., Los Angeles, was awarded a contract for building a sewer in Newton ave., for $5,283.

Oberlin, O.—Buckingham, Clary & Zeigler, of Monroeville, O., secured the contract for constructing a sewer in Hollywood st.

Chattanooga, Tenn.—The contract for constructing a storm sewer in McCallie ave. was awarded to I. H. Mishler, for $4,013.

Rockford, Ill.—G. Maffioli was awarded a contract for constructing a sewer in Central ave., Peach and Independence aves.

Salida, Col.—The contract for building a main sewer in Scott st. was awarded to Peter O'Brien, of Denver, Col., for $53,075.

Hampton, Ia.—The contract for constructing a sewage disposal plant was awarded to J. T. McCormick, of Ft. Dodge, Ia.

Plainfield, N. J.—James A. Christie was awarded a contract for the extension of the sanitary sewer system in the west end of this city.

Fargo, N. D.—L. W. Schruth was awarded contracts for constructing sewers, as follows: Fifth ave., s., $1.28 a

lin. ft., $59 for manholes, $50 for catchbasins, and $1.50 for combined manhole and flush-hole; 12th ave., N., $1.50, $65, $59 and $156 respectively; 14th st., $1.40, $60, $59 and $126 respectively.

Camden, N. J.—The Central Construction Co. was awarded a contract for constructing a storm sewer in Estaugh ave. and W. Main st.

Evansville, Ind.—Ben Newman Co. secured the contract for constructing a sewer in 6th st.

Long Prairie, Min.—The contract for sewer work was awarded to Bosworth Bros., of Ada, Minn., for $3,390.

Oakland, Cal.—J. F. Greaney was awarded the contract for building a storm sewer in Market and 7th sts., for $5,551.

New Westminister, B. C.—The contract for constructing the 8th st. sewer was awarded to T. F. Sinclaire, of Revelstoke, for $65,995.

Lestershire, N. Y.—The contract for constructing a sewer in Main st. was awarded, Oct. 3, to F. E. Whitemore, of this city, for $3,289.

Ogden, Utah.—The contract for constructing sewers was awarded, Oct. 10, to the Wheelwright Construction Co., of this city, for $4,500.

Hamilton, O.—Wirtz and Trunck secured contract, Oct. 11, for constructing sewers in 8th and 9th sts., for $1,551 and $1,585 respectively.

Richmond, Va.—The contract for constructing the main trunk of the big Clay ward sewer was awarded to Stamper, Ragland & Co., Oct. 19, for $80,489.

Boston, Mass.—The contract for constructing sewers in Marten, Leslie and Wildwood sts. was awarded to Luke D. Mullen, 161 Devonshire st., for $5,168.

Chickasha, Okla.—The contract for constructing sanitary sewer extensions was awarded to the Hamilton Bros. Construction Co., of Chicago.

Bloomfield, N. J.—The contract for constructing reinforced concrete pipe sewers was awarded, Oct. 18, to John Boylan, of Belleville, for $12,231.50.

Dayton, O.—Shafer & Dill have been awarded contracts for constructing sanitary sewers, as follows: Districts Nos. 4 and 5, $7,571; District No. 6, $2,122.

Marble, Minn.—E. Boulett, of Virginia, has been awarded the contract for sewage and water mains. The Oliver Mining Co. is to supply water to the city limits.

Youngstown, O.—W. E. Gartland, of this city, was awarded contracts for sewer construction, as follows: Loga ave., $15,529; Rayen ave., $3,943.

Flint, Mich.—Thomas Bergen was awarded the contract, Oct. 17, for constructing sewers, as follows: Avenue A and Word st., $1,685.30; Stevens st., $393.60.

Delaware, O.—The Sherman-Riggs Co., engrs., of Toledo, O., have been awarded the contract for preparing plans and specifications for the new sewage disposal plant to be built by the city.

Ft. Crockett (Galveston), Tex.—The contract for constructing a sanitary sewer and sewage pumping plant here was awarded to Kelso & Vantrin, of Galveston, for $16,950.

Grass Valley, Cal.—Jas. Steed was awarded the contract for the extension of the sewer system in Carpenter st. at 18 cents a foot. The Alpha Hardware & Supply Co. secured the contract for furnishing the material.

Galveston, Tex.—The contract for extending the 33rd st. sewer from Avenue P ½ and Q to the government reservation, at 39th st. and Avenue U was awarded to A. C. Falligant, for $6,555.

El Paso, Tex.—Contracts for constructing sewer and garbage disposal plants have been awarded, as follows: Sections 1 and 3, Sorrenson & Morgan, $28,980 and $31,344; section 2, W. R. Anderson, $36,000

Norristown, Pa.—The contract for constructing an 8 in. sanitary sewer in Pine st. was awarded to R. John Phipps, of this city, as follows: $1.59 a lin. ft. for main sewer; $1.53 a lin. ft.; $125 each for flush tanks.

Guthrie, Okla.—A contract has been awarded W. F. Powers at $9,005, for the construction of the East Side sewer. The bid of Smith & White, which was $80 lower, was rejected as unsatisfactory. E. B. Hocker, cy. engr.

West Allis, Wis.—L. W. Schruth, of Fargo, N. D., has been awarded contracts for constructing 24,480 ft. of pipe sewers, as follows: 8-in. sewer, per lin. ft., $1; 10-in., $1.25; 12-in. $1.38; 15-in., double strength, $1.58; 18-in., double strength, $2.30, and 6-in. pipe, 40c.

WATER WORKS.

CONTEMPLATED WORK.

Baton Rouge, Ia.—A $6,000 extension of the water system is planned.

Lynn, Mass.—Plans have been completed for constructing a filtration plant.

New Carlisle, O.—Voted to issue bonds for installing a water works system.

Onaga, Kas.—Voted to issue $18,000 bonds for constructing a water works system.

Aransas Pass., Tex.—A municipal waterworks to cost $25,000 is planned.

Adair, Ia.—Voted to issue $20,000 bonds for constructing a waterworks system.

Lockport, La.—A water system is under consideration and plans are being made.

Libby, Mont.—About $100,000 is to be expended for water works and street lighting.

Spokane, Wash.—Plans have been completed for laying 31 miles of 4 to 14-in. water mains.

Corning, Cal.—Voted to issue $70,000 bonds for constructing water works and sewerage systems.

Madison, Minn.—A water works system is contemplated.

Benton, Pa.—A municipal water works system is contemplated.

Winsted, Conn.—A municipal water works system is contemplated.

Slayton, Minn.—The extension of the water works system is contemplated.

Yerington, Nev.—The council has decided to erect a tank 100 ft. high, with capacity of 100,000 gallons.

Denison, Tex.—This city voted to issue $50,000 bonds for enlarging and improving the water works system.

Chisholm, Minn.—About $80,000 has been appropriated for the extension of water service, filtration plants, etc.

Sallisaw, Okla.—Voted to issue $16,000 bonds for constructing water works and electric light plant extensions.

Wooster, O.—A resolution has been passed providing for the issue of $35,000 bonds for installing a new water supply system.

Oklahoma City, Okla.—Will vote, Nov. 8, on the issue of $350,000 bonds for the improvement of the water department.

Homer, Mich.—This city voted to issue $20,000 bonds for providing a pumping station.

West Carrolton, O.—Plans are being prepared for improving and enlarging the

water works system, including a new pumping station and concrete reservoir.

Winnipeg, Man.—The question of constructing a new water supply will be voted on.

Newton, Ia.—Council is considering the question of constructing a new stand pipe.

Minot, N. D.—This city will erect a dam for the purpose of conserving the water supply.

Kingston, Ill.—This town voted to issue $4,000 bonds for constructing a new water works system.

Collbran, Col.—Voted to issue $9,000 bonds for constructing a municipal water works system.

Clay Center, Kas.—A resolution has been adopted to construct a 2-in. water main in Lincoln st.

Helena, Mont.—This city will vote Jan. 29 on the advisability of issuing $650,000 water bonds.

Clinton, Ill—A new electric pumping plant for the water works system is contemplated by the city.

Galesburg, Ill.—This city will vote Nov. 8 on the issue of $75,000 bonds for water works improvements.

Martinez, Cal.—An electric or gasoline-driven water works system is contemplated. E. C. Brown, engr.

Birmingham, Ala.—The improvement of the water and light plants is contemplated at a cost of $30,575.

Anna, Ill.—Plans for a water works system are being prepared by C. W. Brown, of Jacksonville, Ill.

Eldorado, Okla.—The citizens have voted in favor of the construction of a municipal water plant. Bids will be advertised for.

Dawson, Tex.—The city has voted to issue bonds to the mount of $8,000 for the erection of a complete water supply system.

Athens, Tenn.—Walter G. Kirkpatrick, of Jackson, Miss., will report on a proposed water works system for the Ingleside Water Co.

Medway, Mass.—Voted to issue $95,000 bonds for constructing a water works system. Robt. C. Donnell, secy. water comr.

Salt Lake City, Utah.—The city proposes to extend the water mains on the northeast bench about 3,700 ft. Estimated cost $15,000.

Portsmouth, O.—Will vote Nov. 8 on the issue of $300,000 bonds for constructing a water works system. W. N. Gobleman, cy. audt.

Kirkwood (Atlanta P. O.), Ga.—This city voted to issue $60,000 bonds for drilling an artesian well, and laying water and sewer mains.

South Forks, Pa.—Plans for installing a mechanical filter plant will be made for the South Fork Water Co. by Chester & Fleming, of Pittsburg.

Coshocton, O.—Resolutions have been adopted for improving the water works system by installing a hydraulic pump and making other improvements.

Lubbock, Tex.—The city is considering the construction of water works and a sewer system. Estimated cost, $80,000. E. L. Dalton, engr., Dallas.

Minneapolis, Minn.—The capacity of the new filter plant is to be increased from 33,000,000 to 39,000,000 gallons. Two electric centrifugal pumps will be needed.

Monroe, La.—The construction of 2 additional concrete water reservoirs to be used as settling basins, and a new system of standard c. i. water mains, is contemplated.

Texarkana, Ark.—Extensive improvements to the water works system is contemplated by the Texarkana Water Corporation, including new mains, standpipe, etc.

Helena, Mont.—Plans and specifications have been adopted for constructing a municipal water works plant. The question will be voted on in January. Mayor Edwards.

Tower, Minn.—A consulting engineer will be engaged to estimate the cost of installing an adequate water works system.

Ft. Worth, Tex.—An extension of the water works system is urged, and an advisory board is planned for the purpose.

Ballinger, Tex.—This city voted to issue $16,000 bonds for extending and otherwise improving the water works system.

St. Paul, Minn.—The Municipal Research Commission has engaged D. H. Maury, of Peoria, Ill., to make investigations and surveys for the city water supply.

Birmingham, Ala.—This city will engage an expert to make an investigation of the water plant in North Birmingham and report on the improvements needed.

Long Beach, Cal.—The water works commissioner recommends the installation of a pumping plant, using electricity or gasoline for power. Plans have been approved for such a system.

Austin, Tex.—The purchase of another turbine engine, at a cost of $14,000, as a reserve and auxiliary, is recommended by Councilman Bartholomew.

Lewistown, Mont.—The question of issuing bonds for replacing the wooden water mains with iron pipe and rebuilding the entire system will be voted on in November.

New York City.—Plans for increasing the water supply of Queensboro by the extension of the city's service are being discussed. Henry S. Thompson, comr. dept. water sup.

Flint, Mich.—The special investigating commission is in favor of constructing a water filtration plant at a cost of $400,000. An additional pump will also be needed. Mayor Selby.

Dallas, Tex.—The Board of City Commissioners decided, Oct. 18, to sink 5 additional artesian wells to augment the water supply. The wells will be sunk in the vicinity of Turtle Creek pumping station and Bachman's reservoir, by Driller R. H. Dearing.

CONTRACTS TO BE LET.

Boaz, Ala.—Until about March 1 for constructing a water works system, steel tank and trestle.

Brookline, Mass.—Until Nov. 3 for furnishing and installing a pumping engine. F. F. Forbes, superintendent water.

Triumph, Minn.—Bids are asked until 8 p. m. Nov. 1 for constructing a 4 in. tubular well. L. O. A. Stockwell, vil. rcdr.

Owensboro, Ky.—Bids are asked until Nov. 1 for constructing a water softening plant, with concrete settling basin. S. Lambert, mayor.

Chicago, Ill.—Bids are asked until Nov. 2 for constructing water service pipes in several streets. Albert F. Keeney, prest. bd. local impvts.

Appleton, Minn.—Bids are asked until 8 p. m., Nov. 7, for constructing a pumping plant for a 15-in. well 185 ft. deep. Manford Horn, cy. recdr.

Boise, Idaho—Until Dec. 1 for furnishing 234 lateral headgates for the Boise Project. U. S. Reclamation Service, Shaw Bldg., Boise.

Chanute, Kas.—Until 5 p. m., Nov. 7, for installing 3 30-h. p. boilers, and laying

9 miles 4 and 10-in. water mains. W. F. Sams, cy. clk.

Fort Crook, Neb.—Until 11 a. m., Nov. 4, Lieut. A. W. Lane, constructing quartermaster, constructions of reservoir and well, 10 per cent. check.

McLeansboro, Ill.—Until Nov. 3 for constructing a reservoir and filter, and the extension of the water mains. John R. Cross, mayor; O. M. Rice, cy. clk.

Binghamton, N. Y.—Bids are asked until 1 p. m., Nov. 1, for constructing a 5,000,000 gal. distribution reservoir. John D. Davidson, secy. bd. water comrs.

New York City.—Bids are asked until Nov. 2 for furnishing c. i. pipe, special castings, and valve box casting in all the borough. Henry S. Thompson, comr. water sup., gas and electricity.

Portland, Ore.—Bids are asked until Nov. 30 for constructing the Lost River diversion channel, about 7 miles southeast of Klamath Falls, Ore., Klamath Project, California-Oregon. Frank Pierce, acting secy.

Klamath Falls, Ore.—Until 2 p. m., Dec. 15, for constructing the Lost River diversion works, located 6 to 10 miles southeast of here, requiring concrete diversion dam, culverts, bridges, etc. U. S. Reclamation Service, Washington, D. C., Portland or Klamath Falls.

New York City.—Until 2 p. m., Nov. 2, for constructing water mains and appurtenances in various sts. in Borough Park, Lepperts Park, Mapleton and Coney Island districts, Boro of Brooklyn; furnishing and delivering cast iron pipe, special castings, and valve-box castings. Henry S. Thompson, comr. of water sups., etc.

San Augustine, Tex.—This city voted to issue bonds for installing a water works system.

Munday, Tex.—This city voted to issue $10,000 for constructing a water works system.

Hearne, Tex.—The question of installing a water works system may be voted on in the near future.

Yazoo City, Miss.—Bids are asked until Nov. 9 for boring an artesian well. S. S. Guffin, clk. co. supvrs.

Mt. Airy, O.—This village has under consideration an issue of $12,500 bonds for constructing a water works system.

Georgetown, Tex.—This city is considering the question of issuing $45,000 bonds for the purchase of the water and light plant.

Ada, Okla.—The city council will call an election to vote on the issue of $100,000 bonds for constructing a water works system.

Ft. Oglethorpe, Ga.—Bids are asked until Nov. 15 for constructing a sterilizing plant at this post. Capt. G. Videner, constr. Q. M.

Manitou, Okla.—Bids are asked until 2 p. m., Nov. 3, for constructing 3,700 ft. 6-in. and 8,400 ft. 4-in. c. i. pipe, 10,000 ft. 6-in. wood pipe, hydrants, valves, standpipes, etc. J. M. George, cy. clk.

CONTRACTS AWARDED.

Eveleth, Minn.—The Fayal road water main extension was awarded to the Pastoret-Lawrence Co. of Duluth.

Hastings, Minn.—A. H. Truax, of Hastings, has the contract for sewer and water works construction, $20,199.

Orrville, O.—Eshelman & Bechtal Co., city, have the contract for laying about 9,482 ft. 4 to 10-in. pipe, $7,922.

Heavener, Okla.—L. Y. McFarland, of Bartlesville, was awarded the contract for a $50,000 water works system.

Chisholm, Minn.—Joseph Cummings was awarded a contract for erecting piers under the new settling basins for $3,118.

Bowbells, N. D.—George W. Kemper, of this city, has been awarded a contract for constructing the water works system.

Audubon, Ia.—The Des Moines Bridge & Iron Co., of Des Moines, has been awarded a contract for a new stand pipe, for $2,478.

Harrisburg, Pa.—The contract for constructing a 1,000,000 gal. concrete reservoir was awarded to W. S. Miller, Telegraph Bldg., for $17,705.

Underwood, Ia.—The contract for constructing a water works system was awarded to the Des Moines Bridge & Iron Works, of Des Moines, for $7,000.

Salt Lake City, Utah.—P. J. Moran was awarded a contract, Oct. 10, for water main extension in City Creek Canyon, for $119,739.

Limon, Col.—The contract for constructing a water works system was awarded to Marshall Bros., of Las Animas, Col., for about $21,000.

Valley City, N. D.—The contract for constructing 2,541 feet of water mains was awarded to the Valley Cty Plumbing & Heating Co., for $2,875.

Austin, Minn.—The J. W. Turner Improvement Co., of Des Moines, Ia., was awarded the contract for constructing a gravity water system for $38,885.

Kansas City, Mo.—The contract for constructing a new water intake at the Quindaro Station was awarded to the Union Bridge Co., Oct. 12, for $63,000.

Milford, Neb.—The contract for constructing a water works system was awarded to the Inter-Mountain Bridge & Construction Co., of Tecumseh, Neb., Oct. 10.

Cloquet, Minn.—The Pastoret-Lawrence Co., of Duluth, have the contract for 7,000 ft. 6-in. s. i. pipe; 7,000 ft. 8-in. sewer pipe; 18 manholes; and construction; $16,500.

Jacksonville, Fla.—The Logan Concrete & Engineering Co., of this city, was awarded the contract for constructing a covered reinforced concrete reservoir, Oct. 4, for $57,500.

Belle Fourche, S. D.—The contract for constructing a water works system was awarded to the Western Engineering Co., of Yankton, S. D., for $50,000.

Broken Arrow, Okla.—The contract for constructing a water works system was awarded to the Southwestern Construction Co., of Oklahoma City.

Provo, Utah.—The contract for constructing the aqueduct and supply mains was awarded to the James Kennedy Construction Co., of Salt Lake City, for $51,845 and $64,359 respectively.

Marble, Minn.—The contract for constructing a water works and sewer system, bids opened on Sept. 12, has been awarded to H. V. Bartlett Co., Virginia, Minn., at $24,500.

Waterloo, Wis.—The contract for constructing 18,000 feet, 4, 6, 8 and 10-in. mains, setting 5 hydrants, valves and valve boxes, was awarded to F. E. Kaminski, of Watertown, for $7,554.

North Platte, Wyo.—The contract for furnishing c. i. pipe for the Pathfinder reservoir, North Platte Irrigation Project, was awarded to the Charles F. Elmes Engineering Works, 50 Morgan st., Chicago, for $6,500.

St. Paul, Minn.—Charles Kampfer & Sons, of this city, was awarded the contract for constructing a brick pumping station at Centerville Lake and Robinson Cary and Sands, the contract for installing equipment, for $14,800.

Kansas City, Mo.—The contract for constructing 8,000 ft. of revetment on east side of Missouri river, to prevent wa-

ter from flowing away from the water intake at Quindaro, was awarded to Farney & Baker, of this city, for $90,085.

Alva, Ore.—Lund, Keenan & McCarthy, of Blackwell, Okla., secured the contract, Oct. 4, for water works extensions, for $5,634. The Chicago Bridge & Iron Works, of Chicago, was awarded a contract, Oct. 6, for constructing a steel reservoir.

Moline, Ill.—The contract for constructing water mains and sewers in the residence portions of this city have been awarded to C. A. Berglund, for $1,287.30 and $798.50 respectively.

Pella, La.—Joseph E. Bortenlanger, of Omaha, Neb., has been awarded five of the eleven contracts by the city council of Pella, La., for the work and material for the town's new $80,000 water and lighting systems. Mr. Bortenlanger's contract amounts to $42,644.

BRIDGES.

Lawrence, Mass.—Masonry work for bridge in Billerica st., to Coughlin & Shells, $2,285.

Muskogee, Okla.—County is considering election on $200,000 bonds for erection of bridges.

Jacksonville, Fla.—To Horn & Neff, Slatington, for constructing bridge over Ontetaunee creek.

Peoria, Ill.—Plans were approved Oct. 20, for the proposed new steel bridge.

Bristol, Pa.—Bucks county comrs. will erect concrete span bridge over Adams Hollow creek.

Merced, Cal.—Plans have been prepared for constructing 5 concrete bridges. C. D. Martin, cy. engr.

Omaha, Neb.—The construction of a viaduct for 30th street in the Sheely district, is contemplated by the city council.

Boston, Mass.—The committee on highways voted to recommend the new steel bridge at Bemis st.

Greenfield, Ind.—Bids are asked until Nov. 7 for constructing 3 bridges. C. H. Troy, co. audt.

Vincennes, Ind.—Bids are asked until Nov. 9 for repairing 7 steel bridges. John Scott, co. audt.

Crown Point, Ind.—Bids are asked until Nov. 7 for construction or repair of 4 bridges. Chas. A. Johnson, co. audt.

Missoula, Mont.—City Engr. Fred Buck is designing bridge which city proposes to build across Rattlesnake creek, near its mouth.

Noblesville, Ind.—The contract for erecting a bridge over Fall creek was awarded to John W. Ascott, of Anderson, for $8,484.

Steubenville, O.—City Engr. Leech has submitted two sets of plans to the board of control for a bridge to span Lincoln creek.

Cincinnati, O.—Bids are asked until Nov. 11 for constructing a concrete bridge on Fallis road. Fred Dreihs, clk. co. comrs.

St. Paul, Minn.—City Engr. Rundlett has prepared plans for a cement bridge over E. 7th and Earl sts., to cost about $35,000.

Montmagny, Que.—Bids are asked until Dec. 1 for constructing an iron bridge over the Riviere du Sud. A. Renaud, secy.-treas.

Albany, N. Y.—State Engr. and Srvyr. Williams approved plans, Oct. 15, for erecting a concrete bridge on the Burdick road.

Brady, Tex.—Two bridges will be built across the Colorado, one at Waldrip and one at Stacy, and one across the San Saba at Voca and one in the town of Brady across Brady creek. The four bridges will call for an aggregate expenditure of $42,000.

Mays Landing, N. J.—County has sold $60,000 bonds to rebuild 3 large bridges across meadows from Pleasantville to Atlantic City.

Polk, Neb.—The commissioners of Polk and Merrick counties have decided to build a bridge across the Platte river north of here, at Little's Island.

Norwich, Conn.—The contract for constructing a new bridge across Four-Mile river has been awarded to Morton F. Plant, of New London.

Indianapolis, Ind.—Bids are asked until Nov. 11 for constructing a bridge over Fall creek in Washington township. Albert Sahm, co. audt.

Norristown, Pa.—The contract for constructing a 3-arch stone bridge over Perkiomen creek was awarded, Oct. 10, to the Toledo & Massillon Bridge Co.

Dallas, Tex.—The contract for erecting the Dallas-Oak Cliff viaduct was awarded, Oct. 10, to Corringan, Lee & Halpin, of Kansas City, Mo., for $44,500.

Tunica, Miss.—Tunica Co. Comrs. have authorized $50,000 bond issue for construction of bridges and roads. E. P. Mangum, president bd. of supvrs.

Richmond, Va.—Council has appropriated $2,000 for competitive designs for construction of a new structure to replace the present Mayo's bridge; cost $250,000.

Texarkana, Ark.—Austin Bros., of Dallas, Tex., were awarded the construction of a steel bridge at McKinney's bayou, $2,200. The Day creek bridge was let to W. A. McColm, city, $515.

Spokane, Wash.—The cy. engr. has been directed to prepare a rough sketch and estimates of the cost of building a concrete bridge on Hangman creek.

San Diego, Cal.—Bids are asked until 2 p. m., Nov. 10, for constructing a bridge across the Santa Marguerita river, near Ysidora. Wm. H. Francis, co. clk.

Wheeling, W. Va.—Road and bridge com. of co. engrs. has instructed A. S. Bell, co. road engr., to prepare plans and specifications for rebuilding Bethany pike bridge.

Pueblo, Col.—Bids are asked until Nov. 7 for the removal of the present steel bridge across the Arkansas river at Union ave. and constructing a new steel bridge. D. F. Gaymon, cy. engr.

Ocean City, N. J.—The Cape May County Board of Freeholders has instructed its engineer to prepare plans and specifications for a bridge between Beesleys Point and Somers Point, connecting the counties of Cape May and Atlantic. Estimated cost is $300,000.

Topeka, Kas.—The contract for completing the Melan bridge extension, which was begun last spring by Johnson & Co., of Kansas City, was awarded to James O'Conner & Son, of Kansas City, Mo., Oct. 17, for $33,397.

Bellaire, O.—Bids are asked until Nov. 5 for constructing a suspension foot bridge over McMahon's creek at Georgetown, 1½ miles west of here. Geo. Kern, prest. bd. trustees; John P. Lowman, clk. Pultney twp.

Petersburg, Ind.—Bids are asked until Nov. 9 for constructing 3 steel bridges in Washington, Madison and Jefferson twps. Frank R. Bidderback, co. audt.

St. Louis, Mo.—Plans for the Compton ave. viaduct have been approved by the board of public improvements so far as the general outline and style of the structure is concerned, and it now only remains for the detail plans to be com-

pleted and approved; the viaduct is to be entirely of reinforced concrete, the full width of the street, and is to cost about $370,000, all to be paid by four railroads; there is to be no steel superstructure.

STREET LIGHTING.

Union, Ore.—This city voted to issue bonds to install an electric light plant.

Hannibal, Mo.—The Citizens' Gas Co. is planning $125,000 improvements. J. W. Thompson, prest.

Drexel, Mo.—Plans are being prepared for installing an electric light plant by A. J. Harbison.

Sulphur, Okla.—Congress will be asked to appropriate $122,404 for Platt National Park here.

Aurora, Ill.—A water power scheme involving 3 concrete dams across the Fox river is being considered.

Rockford, Ill.—The city intends to purchase a new engine and dynamo for their power plant, to cost about $4,000.

Osyka, Miss.—Nov. 1, X. A. Kramer, C. E. Magnolia, Miss. Building $20,000 electric light plant and water works.

Parkersburg, W. Va.—Bids will be asked for soon for lighting the streets, on the basis of 1 and 10 year contracts.

Decorah, Ia.—The American Construction Co., of Newton, Ia., has contracted for the building of a gas works in this place.

Paris, Tex.—A combined electric light and water works plant is contemplated by the city council. E. H. McCuistion, mayor.

Almonte, Ont., Can.—The contract for erecting concrete dams on outlets of Lakes Gull and Cross, to A. C. Gilmour and George Bradford, city.

Jacksonville, Fla.—The Schofield Engineering Co. has been awarded the contract for the new electric light plant. Cost about $375,000.

Paintsville, Ky.—The contract for building and equipping an electric light and water plant was awarded to Stuart H. Bowman and H. H. Hughes, of Huntington, W. Va.

Canby, Minn.—Until 8 p. m., Nov. 3, J. J. Dodds, cy. engr. Electric equipment for operating sewage pump; 15-k.w. a. c. generator, switchboard, 75-h.p. motor, etc.

Prince Albert, Sask., Can.—The city has authorized C. H. Mitchell, of Toronto, to prepare plans for a 10,000-h.p. water power development, to cost $1,000,000.

Baldwinville, N. Y.—The general contract for erecting power house here for the Seneca River Power Co. was awarded, Oct. 14, to D. E. Wadsworth, of Fulton.

New York City.—Until Nov. 1, for constructing and installing electric light system in several buildings of the department of street cleaning. Wm. H. Edwards, comr. st. cleaning.

Culiacan (Sinaloa), Mex.—Surveys, estimates, etc., are being made preliminary to establishing a large electric power enterprise on the Pacific coast of Mexico. The Mayo River Power & Land Co., of Denver, Col., is promoting the project.

Beverly, Wash.—Plans have been completed for an auxiliary pumping plant at the lower end of the Strahon power ditch at Priest Rapids.

Montevallo, Ala.—Plans are being considered for installing an electric light and power plant for lighting residences, and power for dairy and farm machinery. Dr. R. A. Berry.

Forest Grove, Ore.—A franchise has been granted A. Welsh, of Portland, to erect and maintain poles and wires along certain streets for the transmission of power and electricity.

Spokane, Wash.—This city is considering plans presented by George W. Armstrong, prest. of the bd. of pub. wks., for a municipal water, light and power plant, which will cost, if the plans are adopted, $400,000.

Casselton, N. D.—W. T. Sprake advises us that he desires someone to put in an electric light plant in this city. A liberal franchise will be granted. About 100 k. w. machinery desired.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Amarillo, Tex.—A garbage crematory is contemplated.

Duluth, Minn.—A levy of $15,000 has been made for the building of an incinerator.

Rochester, N. Y.—Specifications will be prepared for erecting a refuse incinerating plant.

San Francisco, Cal.—Until Nov. 16, bd. of pub. wks., city hall. Two incinerating plants, 120 tons each; cost $250,000.

Superior, Wis.—The board of health will petition, the city council for an appropriation of $15,000 for constructing a garbage incinerator.

Erie, Pa.—The city will erect a $50,000 incinerating plant. Thos. Hanlon, clk., city hall; Benj. E. Briggs, cy. engr.; C. C. Brown, Indianapolis, consulting engr.

Columbus, O.—An ordinance was approved, Oct. 7, by the council finance committee, to appropriate $20,000 for erecting a supplementary plant at the garbage disposal works.

FIRE APPARATUS.

Lake Charles, La.—The city desires to purchase an automobile fire wagon and one hose cart.

Twin Falls, Ida.—This place has voted bonds in the sum of $50,000 for street paving, fire apparatus, etc.

Duluth, Minn.—The bd. of fire comrs. is advertising for a new gasoline fire engine for use at New Duluth.

Washington, D. C.—F. J. Wagner, chief of the fire dept., is advocating the purchase of motor fire apparatus.

Duluth, Minn.—The council authorized the secy. of the bd. of fire comrs. to advertise for a fire engine for New Duluth, to cost about $3,000.

Moline, Ill.—Bids are to be asked soon for the purchase of a combination auto truck. Chief Hawk.

Lake Charles, La.—The purchase of equipment for the new fire station is proposed by the city council.

Freeport, Ill.—The contract for constructing the West Freeport fire station was awarded, Oct. 17, to Garman Bros., for $4,793.85.

Highland Park, N. Y.—Bids are asked until 8 p. m., Nov. 10, for furnishing 300 ft. 2½-in. hose. Jas. R. Earle, clk. boro council.

Escanaba, Mich.—This city will vote, Nov. 8, on the issue of $15,000 bonds for the construction and equipment of the proposed fire station in the 7th ward.

Fremont, Neb.—Bids are asked until Nov. 7, for furnishing the city with a combination hose and chemical power driven fire apparatus, completely equipped with the exception of fire hose. P. A. Nelson, chm. bd. pub. wks.

Municipal Engineering

VOLUME XXXIX DECEMBER, NINETEEN HUNDRED TEN NUMBER SIX

Hydro-Electric Practice

By H. A. von Schon, M. Am. Soc. C. E., Consulting Engineer, Detroit, Mich.

Precipitation and Run-Off.

IN THE evolutions of civilization two purposes have steafastly been kept to the fore, economic production and lavish consumption; nowhere is this more emphasized than in our own country, and of no other specific development is this more true than of power application. In fact the strides of mankind made during the last semicentury are to be credited chiefly to the mastery of power agencies which has substituted the machine for the man, the engine for the animal, has annihilated space and time and now yields to the efforts of one generation results and accomplishments never dreamed of by all who preceded it.

The peoples of the earth have come to fully realize this potent influence of power utilization on every phase of human endeavor and undertakings and, in the light of this revelation, the civilized nations of the world are even now studying means and methods and are putting into action policies which best promise to secure to them the most economic and fullest future enjoyment of nature's power resources.

King coal had nigh rung the death knell of the oldest known and utilized source of energy, water power, when the advent of a new rival revolutionized the world's power regimen; transmissible electric energy made its debut upon the power stage and, joined to the old and almost dethroned potentate, the union of hydro-electric power now holds full sway.

But the world has reason to remember the former reign with gratitude, nor is it ready to dispense altogether with its beneficent rule, but its glory is on the wane, and even now we are counting the years during which we may be permitted to yet enjoy it. Yes, "the mill will ever run with the water that has past" is the nowaday version of the one poetical negation of this truth which is the everlasting foundation to the future supremacy of the hydro over the coal-power source; as long as the oceans prevail will hydropower be vouchsafed to mankind.

The economic utilization of the water power is then the present goal, for attaining this renders its liberal application most feasible while it yields, only then, the rewards which are within its gift. This is to be the topic of a series of articles contributed by the author to Municipal Engineering which will be treated in the logical analytical sequence from inception to utilization.

Determining the commercial value of a hydro-electric opportunity should be, and now generally is, the first move in the enterprise. It is followed by the designing and construction of the works, while the desired purpose is finally realized by operation and maintenance of the plant. The most economical utilization of the power source can be secured only if each of these three is executed with thoroughness guided by correct judgment. No industrial undertaking may hope to be successful if it is conceived in error, if the fundamental conditions are misjudged or not explicitly understood. In some lines this is not altogether feasible, speculation of more or less degree can be avoided in the formulation of original plans, which are only cleared by future experience. Hydro-electric enterprises need not be so handicapped, as they can be analyzed with remarkable accuracy. The object is to manufacture a product of uniform quality and fixed quantity, electric energy, and the process utilizes one class of raw material of uniform character, the hydro-power sources, the available volume of which may be determined with accuracy at the outset. Few other enterprises are founded on

such simple conditions. But it is the very simplicity which is the cause of many disappointments in hydro-electric developments, leading first to a dangerous underestimating of the needed care and caution in launching the project and later on to a development which, being conceived in ignorance of the true conditions, is destined to prove a financial failure.

The available power source, the potential flow and fall, can and should be determined with precision. There is no warrant for a hydro-electric plant to experience an abnormal deficiency of flow or fall from that on which the development is based. Where this is the case, the original analysis was in error or the true conditions were knowingly set aside in planning the development.

All the water resources, surface and underground, in the temperate and tropic zones, are due to precipitation, which originates almost wholly from the oceans. The annual precipitation volume varies considerably in a given catchment basin, not because the vaporization of ocean waters differs materially from year to year, but by reason of its ever changing destination as precipitation, which is wholly under the influence of air currents and temperature. Therefore it is true that present normal precipitation is no less nor more than what it has been in the past, and the assumption is likewise warranted that it is not likely to diminish in the future. Our knowledge of precipitation volumes in this country dates practically from the periods of settlements of the different sections, not only as of hearsay and recollections but from recorded measurements at principal points, which system has been gradually perfected so that at the present time the daily precipitation conditions in all sections, and in every river's drainage area, are accurately known.

The normal annual volume in this country varies in different sections from ten to one hundred inches. It is highest on the Atlantic, Gulf and Northern Pacific coasts and grows less inland, being lowest in the east of the Rockies region, that of the Great Basin, so called. On the Washington coast is the point of greatest rainfall, the annual normal exceeding one hundred inches, which is a localized condition due to the near approach of the warm Japanese current. Southerly on the Pacific coast it rapidly decreases, being sixty around Portland, fifty at San Francisco, thirty at Los Angeles and falling to twenty at the Mexican boundary. The Western foothills of the coast hill ranges mark a uniform precipitation belt of twenty inches, so that the change in Washington is from one hundred to twenty inches in a distance of about one hundred miles from the coast. Easterly, across the continent for about twelve hundred miles between longitudes 100 and 120, lies a broad low-precipitation area, being normally twenty inches at the Canadian and fifteen at the Mexican boundary. This comprises the arid regions covering Montana, the Dakotas, Idaho, Wyoming, Nevada, Utah, Colorado, Arizona and New Mexico, extending north and south into the Canadian Northwest and Mexico with still lessening precipitation, so that extreme precipitation fluctuations may be found in a journey from Seattle through the Province of Athabasca, with one hundred inches and more of rainfall at the former, while in the latter section, at some points, it has not rained during the past two years, though there has been some snowfall. On the Atlantic, Cape Hatteras and the section near Mobile, Ala., mark the highest precipitation areas, with sixty inches, decreasing gradually northerly and westerly to about fifty inches along the thirty-sixth parallel, which marks the north boundary of North Carolina, Tennessee and Arkansas, and to about the same volume at the Mississippi valley, and thence it gradually grows smaller in a northwesterly direction, more rapidly westerly from the Mississippi than from the eastern extremity of the fifty-inch belt, to forty inches along a belt on the general direction of the St. Lawrence River, Lakes Ontraio and Erie to the southwest corner of Missouri, and then due south through Oklahoma and Texas. And thus the decrease continues northerly and westerly, the thirty-inch belt passing through Lake Superior and from its western end southwesterly and south about along the ninety-eighth meridian through Nebraska, Kansas, Oklahoma and Texas, while the twenty-inch, as before stated, runs nearly north and south in the proximity of the 100th meridian.

The normal precipitation volumes in the different sections where water power utilization is now or will be an important future asset are for the New England States, 35 to 40 inches; New York, Pennsylvania and Maryland, 40 to 45 inches; Michigan and Wisconsin, 30 to 35 inches; Minnesota, 25 to 30 inches; Iowa, 30 to 35 inches; Illinois, Indiana and Ohio, 35 to 40 inches; Virginia, West Virginia, Kentucky,

Missouri and Arkansas, 40 to 50 inches, and in the remaining Southern States east of the Mississippi, 50 to 55 inches. Those on the Pacific coast have already been detailed, while for eastern Ontario it ranges from 30 to 40 inches and in western Ontario from 20 to 30 inches. Exceptional to these generalized conditions is the high precipitation area, with 65 inches to the southwestern Appalachian range, where Tennessee, the Carolinas and Georgia bound jointly, including Chattanooga and Knoxville, Tenn.

The aggregates of a seven-year cycle are nearly uniform, but in this period the annuals fluctuate greatly. For instance, for a drainage area in Alabama, where the normal precipitation is from 50 to 55 inches, it was in 1903, 59; 1904, 38; 1905, 39; 1906, 56; 1907, 60; 1908, 58; 1909, 59; mean, 52.7 inches; and it is clear at a glance that the investigation for the potential flow must deal with the years 1904 and 1905, as one or more years of such low precipitation are certain to occur and it is not feasible, nor would it be economical, to provide storage or auxiliary power supply to meet the difference in flow value between these and a normal precipitation year. Ordinarily then, one must deal with the dry year conditions and in some cases, as in the one above, the flow in the year following the one of lowest precipitation proved the smallest, because the dry year was preceded by one of abnormally high precipitation, ground storage was plentiful and helped to raise the flow during the dry year, while no such replenishing source was available during the year succeeding the dry.

For the first approximate information as to available potential flow, the evaporation rule may be taken. Only a portion of precipitation finds its way into the streams, a large part is absorbed by vegetation and is vaporized from land and water surfaces; some sinks into the ground, whence it feeds gradually into the river, and finally a part runs off the surface while precipitation falls. The first two are charged to evaporation and they represent 50 per cent. and more of the total precipitation. If the dry year's precipitation is 38 inches, about half of this, or 19 inches, may then, for approximate information, be taken as the available run-off. One inch of water on one square mile represents $5280^2/12$ equals 2,323,200 cubic feet, and dividing this by the number of seconds in the year, 365 by 24 by 60 by 60 equals 31,536,000 seconds, the result is the continuous uniform flow of this volume, being 2,323,000/31,536,000 equals 0.073 cubic second-feet. For 19 inches it becomes 19 by 0.073 equals 1.387 c. s. f. and for a drainage area of 1,000 square miles the annual flow would be 1,387 cubic second-feet. This is the total for the year, and were it uniformly distributed by nature or artificial conserving, it would represent the potential flow. This, however, is not feasible. There may be months during the year when precipitation will be only a small fraction of the twelfth part of the annual thirty-eight inches. There may be two and more months in succession of such condition. Furthermore, it is a fact that evaporation is not uniformly distributed throughout the year but that it is low in the winter, spring and fall and high in the summer months. During the period from June to November evaporation is nearly three times as great as during that from December to May. The former is the growing, the latter the replenishing period, and unless precipitation distribution is in ratio of these evaporation variations, it will be readily understood that the monthly run-off may fluctuate extremely. And finally, the daily flow variations play an important part in potential flow determinations. Unless commensurate storage is provided, the storm run-off during and after a heavy rainfall passes down the river in a few days, and thus greatly reduces the available remainder of the annual run-off.

It is therefore true that a daily-flow analysis of the dry year is the only safe basis from which the potential flow can be determined with results of any practical value, and there is no reason why such a daily-flow analysis may not be made nowadays for any water course in the United States which offers a hydro-electric opportunity of commercial importance.

The Park System of Minneapolis, Minn.

By an Editorial Correspondent

Truly unadorned beauty is made the keynote of the extensive park system of Minneapolis. Mr. Wilbur F. Decker, president of the Board of Park Commissioners, in his 1909 report, states in one sentence the past intentions and future plans for beautifying the Minneapolis parks. He says: "While in many park systems the crowning features are artificial, ours are natural, and our improvements should generally be of a subordinate nature."

The work of acquiring park lands has been practically completed, and the territory now embraced in the park system should prove amply sufficient to provide for all future development. As may be noted from the accompanying diagram, the total area of the Minneapolis parks, including both land and water, is 3,369 acres. Of this 1,280 acres is water area, and the value of water in the development of beautiful parks is so well recognized as to need no comment.

A portion of the park system, known as Glenwood Park and the Lake District, is shown in the map here reproduced. This portion is joined to Mississippi Park by a long strip of land running east from a short distance south of Lake Harriet. This makes a continuous parkway so that one may travel on park land from a short distance south of the city hall, down along a beautiful river drive through Minnehaha Park, thence across the city along Minnehaha Parkway Parkway to Lake Harriet and thence along the borders of Lake Calhoun, Lake of the Isles, Cedar Lake and Brownie's Lake to Glenwood Park. This drive is maintained in faultless condition, the roadways being of oiled sand or macadam, with bordering woods in their natural state of wild beauty. Two of the photographs indicate the charm of scenes along this drive. The length of the drive entire is almost thirty-two miles and it begins and terminates in the better residence section of the city.

Mississippi Park extends along the Mississippi River, as its name would imply; a portion on each side of the river and a number of islands being embraced in the park system. The river at this point has in places eaten its way deep into the rock formations, so that portions of the park lie along wooded bluffs; while the skilful placing of the river drive at points allows of a long uninterrupted view of the city as from a mountain top.

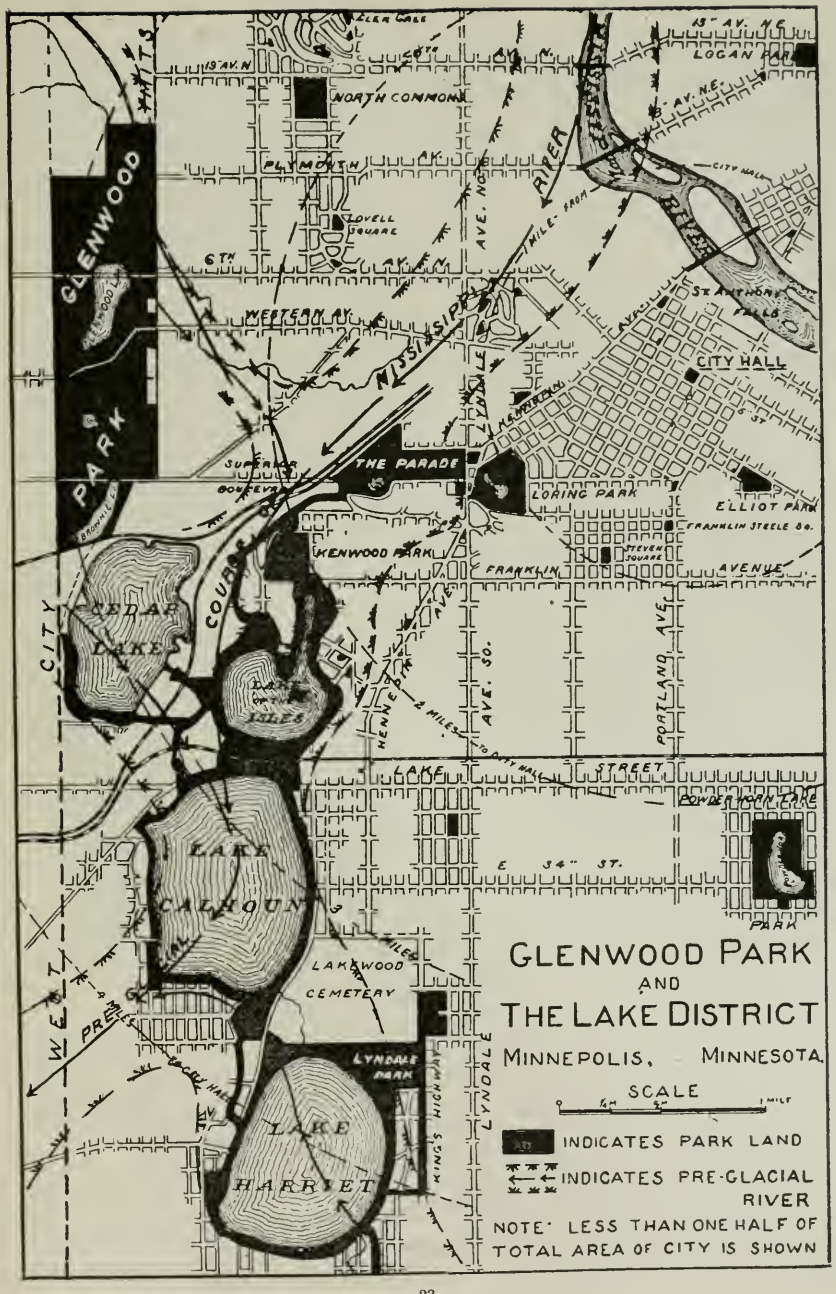
The association of Minnehaha Park with "Laughing Water" makes it perhaps the most attractive park of the system. Rustic bridges, stone steps and occasional stone arches have been added for safety and convenience, but otherwise the tendency has been to avoid all attempt at ornamentation. The long parkway connecting this park to the lake district follows closely along the banks of Minnehaha Creek and many very pretty scenes such as those shown in the second photograph may be noted.

Of the lake district it may be said that more attempts at artificial adornment have been made. Pavilions have been built, where canoes, launches and rowboats may be rented and where refreshments are sold, all under direction of and for the park system. In these buildings the attempt has been made, and in fact accomplished, to make the style of architecture consistent with the natural landscape features. The Lake Harriet pavilion is perhaps the most representative of these. It is a wooden building with a broad pillared portico extending entirely around it. The entire roof of the building is devoted to a roof garden, a band shell occupying the side opposite to the lake.

A more formal treatment of the drives and walks has been observed in the lake district. Here a definite grade has been established, to which the roadways and walks are made to conform, and in many parts curbing has been placed, confining the roadways to regular geometrical curves. Along the borders of the drives of Lake Harriet, single-globe boulevard light standards have been placed, and in addition occasional high-power tungsten lights furnish illumination along the paths.

As very little artificial ornamentation has been necessary throughout the entire system, the park commission has been able to provide for shelter houses, baths, playgrounds, etc. The former are of great value in the enjoyment of the parks during the winter months, as the great water area of the parks makes skating one of the most enjoyable features.

The field house in Camden Park, of



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PARK SYSTEM OF MINNEAPOLIS, MINN.

I. Map of Glenwood Park and Lake District.

which a photograph is given, is representative. It was presented by Mr. and Mrs. C. C. Webber during the year 1909. The field house may be considered as divided into three separate parts, the Camden Park swimming pools, the field house (for shelter) and the Camden Park library.

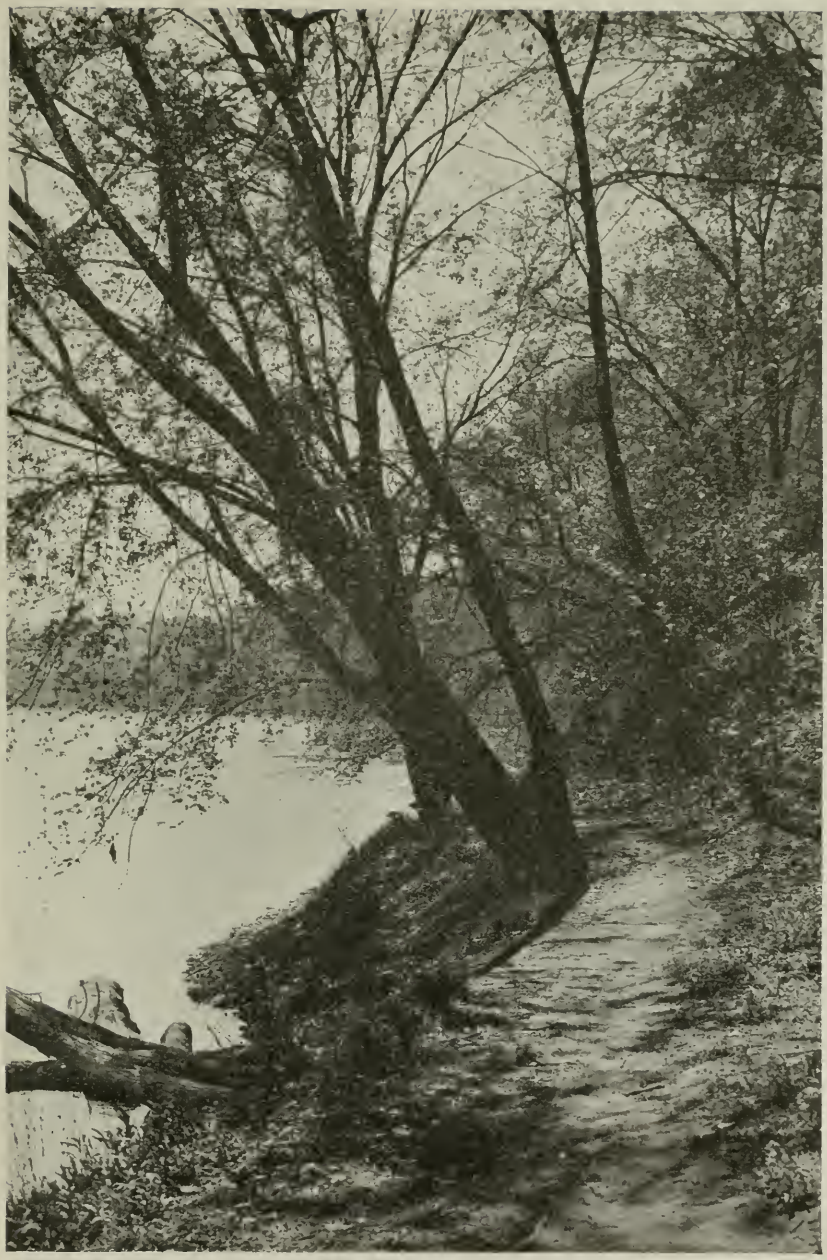
There are two swimming pools, one 60x120 feet in size and from three to four feet deep, and one 45x43 feet and nine feet deep. The depth in both pools can be increased one foot. The pools are fed by the stream passing through them, the flowage being under absolute control through properly arranged spillways and gates. The pools can be emptied in two hours and filled in one hour. They are surrounded by a wide platform, and are enclosed by a wall twelve feet high and with no roof. To the north of the pools are eighty-two double-sized dressing rooms, the office of the attendants, the toilets and shower baths. While the rooms are all roofed the alley-ways are open overhead.

To the south of the main pool and connected with it through a door and tile-roofed porch is the John D. Webber field house, a very attractive and convenient shelter building. The main floor is 53x27 feet in size, and is used as a warming-room during the skating season, for which purposes a checking booth for clothes and skates is provided. In the summer this room will be utilized as a shelter house. Sanitary and modern toilet rooms are connected with this floor. The basement contains a room of the same size, which is so far unassigned. It may, later on, be equipped and utilized for shower baths for winter use. Under the projecting porch and wings of the main building toward Washington avenue are the boiler room and a store-room. Above the shelter room, being a part of the main building, is the Camden Library, a branch of the public library. This is a very handsome room of the same size as the shelter room, conveniently reached from the porch by an easy stairway in the west wing.

PARK SYSTEM OF MINNEAPOLIS, MINN.
II. View on Minnehaha Creek.

The entire set of buildings is of reinforced concrete construction of rough-cast exterior finish, and with a red tile roof. The building is of the Spanish Mission style and presents a very attractive and inviting appearance.

The playgrounds of Minneapolis



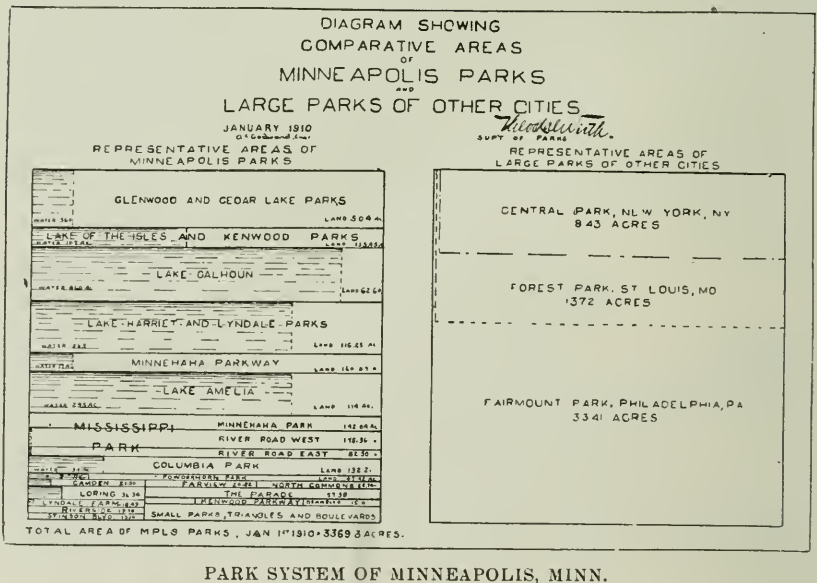
PARK SYSTEM OF MINNEAPOLIS, MINN.

III. Mississippi River Park Along West River Bank.

come indirectly under the supervision of the park commission, and seventeen playgrounds, having a total of twenty-five acres, have been established and equipped. This acreage includes tennis courts, base ball fields, etc. The total attendance at the playgrounds in 1909, something over 496,000, indicates their popularity.

The engineering work of the park department is carried on distinct from the regular city engineering force. Two parties are kept in the field during the entire year, making topographic surveys, soundings, laying out roadways, sewers, and walks, and making up plans and estimates on bridges, dams, etc. One of the most notable undertakings of this department has been the connection of the chain of lakes by means of channels, so as to make a continuous waterway from Lake Harriet to Brownies' Lake. This undertaking will involve the building of channels and locks, so as to maintain the water levels of the different lakes, and the construction of numerous bridges at points where the park drives cross the proposed waterway. In connection with this project it has been necessary to dredge out the Lake of the Isles, converting it from a shallow marsh into a lake with elevated banks forming a raised boulevard around its entire circumference. This work has but lately been completed.

To the efficiency of all departments, and to the thoroughly business administration of all park affairs may be ascribed the credit for the present excellent system. All accounts are kept accurately to the smallest detail, and full publicity is given to every act of the commission. The commission's actions have not always been without criticism from the public and the press, but at present public opinion is heartily in accord with all that has been done. A far sighted policy, which labored to procure all necessary park territory before proceeding to the refinement of any particular area, has been strictly observed; and with a future advancement as marked as has been the past, Minneapolis should have a park system unexcelled by any.



PARK SYSTEM OF MINNEAPOLIS, MINN.

IV. Diagram Comparing Park Areas in Minneapolis and Other Cities.

PARK SYSTEM OF MINNEAPOLIS, MINN.

V. John D. Webber Field House, Camden Park.

Specifications for Asphalt Pavements

By E. M. Perdue, Chemical and Consulting Engineer, Kansas City, Mo.

FOR a number of years I have made the study of asphalt pavement a specialty. In every way I have advocated a closer specification, strict municipal supervision, and the abolition of the five or ten-year maintenance. It is obvious that for these reasons I could have no part in standardizing specifications.

A technical chemical and constructing engineer would gather from the "Standard Specification," adopted by the Organization for Standardizing Paving Specifications, that the asphalt paving industry was in its infancy, that it had no standards, that it was still a matter of experiment and was largely guess work. The facts are that the physical constituents of asphalt pavement are as actually determined as the chemical composition of Portland cement; they can vary within as narrow limits, and can be as satisfactorily and accurately filled by the contractor.

Asphalt pavement is one of the best of pavements. It can be laid on streets of the heaviest traffic so as to need no repair for a period of ten years and at the same time be smooth, clean and sanitary. Yet municipal engineers have permitted paving contractors to influence them to write a wide-open specification and so cloud the real points of value with chemical analyses until the so-called asphalt pavement disintegrates in two years and has become unpopular.

Three pages of your edition of the Standard Specification (5, 6 and 7) are devoted o a confusing, illogical and wholly unprofitable mixture of requirements of derivation, physical and chemical properties, specific gravity, natural asphalts and the products of distiilation. What difference does it make whether an asphalt comes from Trinidad Lake or the Island of Trinidad, the Province of Bermudez, Cuba, Utah, Kentucky or Oklahoma, or is the product of the distillation of an asphaltic, semi-asphaltic or paraffin petroleum; has or has not a particular ductility, viscosity, penetration and flash point; is soluble to a particular percentage in carbon disulfid and carbon tetrachlorid and petroleum naphtha; has a fixed residue of a given percentage on ignition? These requirements only serve to make the specification abstruse, difficult, beyond the comprehension of the average engineer and impossible to the public.

The only considerations of value to the municipality and to the abutting property owner are that the combinations of asphalt and flux, commonly called asphaltic cement or A. C., have the proper ductility, viscosity and penetration to insure a good pavement. These are all physical and not chemical properties. Given proper ductility, viscosity and penetration, and the solubilities, residues, origin and derivation will take care of themselves. Their requirement cumbers the specification, their determination is a useless expense and labor.

A large part of pages 9 and 10 is devoted to the "binder course." Now, there are three good reasons for laying binder.

1. It increases the cost of the pavement to the property owner.
2. It requires more work.
3. It promotes the rapid disintegration of the surface. As a matter of scientific engineering, especially as applied to the principles of viscous pavements, the binder course is obsolete. It is a relic of the early days of the industry. It should never be laid.

The "mixes" of concrete aggregates and the aggregates of macadam, bitulithic, Hassam and asphalt pavements depend upon the theory of bonding density. This rule applies with greater strictness where the bonding material is bituminous. The set of the limes is the chemical process of hydration. It is rigid and absolute. The set of the bitumens is physical and viscous and depends upon temperature. Therefore, to make a rigid pavement, the stability must be in the mineral aggregate and not in the cementing material. For this reason, the sand grading is the most important feature of the mix.

The sand and lime dust can be graded so that the voids will not exceed 25 per cent. This 25 per cent. must be filled by asphaltic cement. The average specific gravity of the sand will be 2.6. The average specific gravity of the asphaltic cement will be 1. The standard percentage of asphaltic cement is 10.0 for light traffic streets and 10.5 for heavy traffic streets. Nine per cent. is a low minimum and 11 per cent. a high maximum.

As asphalt pavement is not laid as a matter of municipal improvement but as a means of exploiting the abutting property owner and mulcting him in liability for special assessments, it is deemed necessary to require a "maintenance bond." This is a two-edged sword, cutting the property owner both ways. The surety is an approved bonding company. This company charges a premium. The contractor adds this premium to his bid. The surety company requires collateral security. The contractor adds this to his bid. The property owner complains of the high cost of the pavement. He is told of the high cost of the surety bond and maintenance. A poor pavement is laid under the common wide-open specification. The property owner complains of the quality of the pavement and the city engineer and board of public works tell him that it makes no difference as the paving company is under bond to maintain the pavement ten years. The pavement disintegrates in two years. The property owners complain. Then ensues an eight years' game of hide and seek between the paving company and four succeeding boards of public works. In the meantime the pavement is a series of bumps and holes and the city has paid several judgments for damages for personal injuries thereon.

The essentials of a good asphalt pavement are as follows:

1. A solid, well-drained sub-base.

2. A base of well-graded Portland cement concrete with a minimum thickness of six inches.

3. No binder course.

4. Asphaltic cement of the following properties: (1) Minimum ductility of 15 at 77 deg. F. (2) Penetration adapted to climatic conditions. A permissible variation of five points.

5. A surface coat two to two and one-half inches thick of the following grading:

	Light Traffic. Pct.	Heavy Traffic. Pct.
Asphaltic cement	10.0	10.5
Sand and filler passing .....200....	10.0	13.0
Sand passing ...100.....	10.0	13.0
Sand passing ... 80....	10.0	13.0
Sand passing ... 50....	24.0	23.5
Sand passing ... 40....	12.0	11.0
Sand passing ... 30....	10.0	8.0
Sand passing ... 20....	8.0	5.0
Sand passing ... 10....	6.0	3.0

The asphaltic cement will bear a variation of one-half per cent., but should average as above. The sand grading should conform to the above standard in average. It will permit a variation of 2 per cent. on the sieves passing the larger amounts and of 1 per cent. on sieves passing the smaller amounts. When such a pavement is laid a maintenance bond is superfluous.

[Editorial Note. This objection to the specifications for asphalt pavements adopted by the Organization for Standardizing Specifications, printed in Municipal Engineering, vol. xxxviii, p. 234, and reprinted in a little volume of "Standard Paving Specifications," should be read in connection with those specifications and the modifications proposed by a sub-committee of the Committee on Standard Specifications of the American Society of Municipal Improvement, which will be found below. Reference may also be made to the accompanying editorial on this subject.]

Proposed Specifications for Sheet Asphalt Pavements

Report to the American Society of Municipal Improvement by F. P. Smith, Asphalt Chemist, New York City

GENERAL DESCRIPTION.

Upon the foundation prepared and laid as elsewhere herein specified shall be laid the pavement proper. This shall consist of:

1. A binder course..... inches in thickness when compressed.

2. An asphalt wearing surface ..... inches in thickness when compressed.

MATERIALS.

The materials used must comply with the requirements of these specifications and be suitable for use upon the street or streets to be paved. They shall be mixed in definite proportions by weight, depending upon their character and the traffic upon the street and upon the character of the asphalt used, and such materials and propor-

tions must be satisfactory to the engineer.

Crude natural asphalt shall be construed to mean natural mineral bitumen, either pure or mixed with foreign matter, from which, through natural causes in the process of time, the light oils have been driven off until it has a consistency harder than 100 penetration at 77 deg. F.

Asphaltic petroleum shall be construed to mean those petroleums which when treated in the manner specified below will give a residue having a ductility of 77 deg. F. of 25 cms. or over.

Semi-asphaltic petroleums shall be considered to mean those petroleums which, when treated in the manner specified below, will give a residue having a ductility at 77 deg. F. of between 5 cms. and 25 cms. and this residue, after being maintained at a temperature of not over 77 deg. F. for forty-eight hours, must have a bright and glossy surface which shows no signs of crystallization.

Method for examination of petroleums—Two hundred grams of the petroleum is to be placed in an open dish and subjected to a temperature in an air bath of not to exceed 500 deg. F. until the residue so obtained shall have a penetration at 77 deg. F. of 50. This residue is then to be tested for ductility at 77 deg. F.

Asphalts whose value for making pavements have not been established in the judgment of the engineer, by sufficient practical experience, will only be accepted under such special bond and guarantee provisions as the engineer may prescribe.

The preparation and refining of all asphalts admitted under these specifications shall be subject to such inspection at the paving plants and refineries as the engineer may direct.

Subject to the proceeding conditions and definitions, the following types of refined asphalt will be admitted under these specifications, provided that when made into asphalt cements by the use of such materials and methods as are described in these specifications they will produce an asphalt cement complying with the specification requirements elsewhere set forth herein for asphalt cements.

All tests herein specified must be conducted according to official methods on file in the office of the engineer.

1. Refined asphalts prepared by heating crude natural solid asphalts without the addition of any other material to a temperature not exceeding 400 deg. F. until all water has been driven off. Such asphalt must melt readily upon the application of heat.

2. Refined asphalt procured by the careful distillation of asphaltic petroleum until the resulting asphalt has a consistency not harder than 20 penetration at 77 deg. F. Such asphalts must comply with the following requirements:

(a) They shall contain not less than 98.5 per cent. of bitumen soluble in cold carbon disulphide.

(b) When 20 grams of the asphalt are heated for five hours at a temperature of 325 deg. F. in a tin box 2 1-2 inches in diameter after the manner officially prescribed, it shall not lose over 5 per cent. by weight nor shall the penetration at 77 deg. F. of the residue left after such heating be less than one-half the penetration at 77 deg. F. of the original sample before heating.

(c) When the asphalt is brought to a penetration at 77 deg. F. of 50 by the use of the flux with which it is to be used and made into a briquette having a cross section of one square centimeter, it shall have a ductility of not less than 25 cms. at 77 deg. F.

Note.—Combinations of asphaltic and semi-asphaltic residues having the ductility and other characteristics noted above are admitted under this section.

3. Refined asphalt produced by combining crude natural asphalt with either or both of the following:

(a) Residuums obtained by the distillation of petroleum oils as specified under fluxes.

(b) Asphalts obtained from the distillation of asphaltic petroleums as specified under paragraph 2 of this section.

Note.—Where more than 5 per cent. of flux is used in the preparation of refined asphalts of this class, only asphaltic or semi-asphaltic fluxes shall be used, except in those cases where the solid natural asphalt is of such character that when mixed with paraffine fluxes without the further addition of any other materials it will produce an asphaltic cement complying with the requirements herein set forth under that head. In such cases, any of the fluxes herein specified may be used.

Fluxes shall be the residues obtained by the distillation of paraffine, asphaltic or semi-asphaltic petroleum and shall be of such a character that they will combine with the asphalt to be used to form a suitable asphalt ce-

ment complying with the requirements of these specifications.

The residuums must have a penetration greater than 3 1-2 cm. with a No. 2 needle at 77 deg. F. under 50 grams weight for one second.

A natural Maltha may be used if it passes the heat and flash tests specified under "a" and all fluxes must remain soft after heating for five hours at 400 deg. F.

(a) Paraffine residuums shall have a specific gravity of 0.92 to 0.94 at 60 deg. F. They shall not flash below 350 deg. F. when tested in the New York State closed oil tester and shall not volatilize more than 5 per cent. of material when heated five hours at 325 deg. F. in a tin box 2 1-2 inches in diameter as officially prescribed.

The residue after heating shall flow at 77 deg. F.

(b) Asphaltic residuums shall have the same general characteristics as paraffine residuums except that they shall have a specific gravity between 0.98 and 1.04 at 80 deg. F. When tested according to the method elsewhere herein described for the examination of petroleums, the residue so obtained shall have a ductility at 77 deg. F. of 25 cms. or over.

(c) Semi-asphaltic residuums shall have the same general characteristics as paraffine residuums except that they shall have a specific gravity between 0.94 and 0.98 at 60 deg. F. When tested according to the method elsewhere herein described for the examination of petroleums, the residue so obtained shall have a ductility at 77 deg. F. of between 5 and 25 cms. and must have a bright and glossy surface which shows no signs of crystallization.

Binder stone shall be clean, hard stone, free from any particles that have been weathered, or otherwise soft material. It shall all pass a 1 1-4-inch screen. Not less than 85 per cent. of the stone shall pass this screen in its largest dimensions, and of the remaining 15 per cent. no piece shall have a larger dimension than two inches. The stone shall be so graded from coarse to fine as to have the following mesh composition (sieves to be used in the order named):

Passing

16 mesh	16 to 35 per cent.
2 mesh	10 to 35 per cent.
Total	25 to 50 per cent.
1 mesh	20 to 60 per cent.
1 1-4 mesh	15 to 55 per cent.
Total	50 to 75 per cent.
Total passing 1 mesh	45 to 85 per cent.

The above limits as to mesh composition are intended to provide for such permissible variations as may be rendered necessary by the available sources of supply and the character of the work to be done. The mesh composition and character of the stone may be varied, within the limits above specified, at the discretion of the engineer, depending upon the kind of asphalt used and the traffic conditions upon the streets or streets to be paved.

The sand shall be hard, clean grained and moderately sharp. On sifting it shall have the following mesh composition (sieves to be used in the order named):

Passing

200 mesh	0 to 5 per cent.
100 mesh	10 to 25 per cent.
80 mesh	6 to 20 per cent.
Total passing 80 mesh and retained on	
200 mesh	20 to 35 per cent.
60 mesh	6 to 20 per cent.
50 mesh	15 to 40 per cent.
40 mesh	10 to 30 per cent.
30 mesh	8 to 25 per cent.
20 mesh	5 to 15 per cent.
10 mesh	2 to 10 per cent.
8 mesh	0 to 5 per cent.

On very light traffic streets, a coarser sand may be used with the approval of the engineer, but in no case shall a sand be employed that contains less than a total of 15 per cent. passing an 80-mesh sieve, such total to contain not more than 5 per cent. (calculated on the original sand) passing a 200-mesh sieve.

The above limits as to mesh composition are intended to provide for such permissible variations as may be rendered necessary by the available sources of supply and the character of the work to be done. The mesh composition and character of the sand may be varied, within the limits above specified, at the discretion of the engineer, depending upon the kind of asphalt used and the traffic conditions upon the street or streets to be paved.

Filler shall be thoroughly dry limestone dust or Portland cement, the whole of which shall pass a 30-mesh per linear inch screen and at least 66 per cent. of which shall pass a 200-mesh per linear inch screen. The surface mixture shall contain from 6 to 20 per cent. of this filler, depending upon the kind of sand and asphalt used and the traffic conditions upon the street or streets to be paved.

Samples of the refined asphalt, petroleum flux and asphalt cement that the contractor proposes to use in his work must be handed in with the bid

and no contract shall be awarded to any bidder whose samples do not comply in every respect with these specifications.

In addition to the samples submitted with the bids, other samples taken from and actually representative of the refined asphalt, petroleum flux, sand and filler to be used upon the street shall be submitted to the engineer before the use of such materials in the work is permitted. Except at his option, no work on binder or surface shall be commenced within three weeks from the date when such samples were submitted and in no case shall they be used until they have been examined and approved by him. Whenever, during the course of the work, new deliveries of paving materials are received by the contractor, samples of these shall at once be submitted to the engineer and their use in the work will not be permitted until they have been examined and approved by him.

ASPHALT CEMENT.

The asphalt cement prepared from the materials above designated shall be made up from the refined asphalt or asphalts, and the flux, where flux must be used, in such proportions as to produce an asphalt cement of a suitable degree of penetration. The proportion of the refined asphalts comprising the cement shall in no case be less than 40 per cent. by weight. When the weight of the flux in the asphalt cement prepared from solid natural asphalts exceeds 25 per cent. thereof, asphaltic or semi-asphaltic flux shall be used.

The refined asphalts and flux comprising the asphalt cement shall, when required, be weighed separately in the presence of the authorized inspectors or agents of the engineer.

The proper proportions of the refined asphalt or asphalts and the flux shall be melted together and thoroughly agitated by suitable appliances until they are completely blended into a homogeneous asphalt cement. The asphalt cement must never be heated to a temperature exceeding 350 deg. F. If the asphalt cement contains material that will separate by subsidence while it is in a molten condition, it must be thoroughly agitated before drawing from storage and while in use in the supply kettles. Approved methods of agitation, which will not injure the cement, must be used.

The asphalt cement shall comply with the following requirements:

(a) When tested with a No. 2 needle in a Dow penetration machine, or its equivalent, it shall have a penetration, expressed in hundredths of a centimeter, within the following limits: It shall be between 35 and 75 penetration at 77 deg. F. under a weight of 100 grams for five seconds, depending upon the asphalt used and the traffic upon the street on which the pavement is to be laid.

(b) It shall not flash below 350 deg. F. when tested in a New York State closed oil tester.

(c) When heated in an open tin at a temperature of 325 deg. F. for five hours in a hot air oven, it must not show a loss by volatilization of over 5 per cent. and the penetration at 77 deg. F. of the residue left after such heating must not be less than one-half the penetration at 77 deg. F. of the original sample before heating.

(d) When the pure bitumen of the asphalt cement is brought to a penetration at 77 deg. F. of 50 and made into a briquette tapering in the middle to a minimum cross section 1 cm. square, it must stretch to a distance of 15 cms. or over without breaking when tested for ductility at 77 deg. F.

BINDER.

The binder shall be composed of stone and asphalt cement of the character elsewhere herein specified and mixed in proper proportions. If the stone does not contain the proper amount of material passing the 1-2-inch screen, the deficiency may be made up by the addition of gravel or sand. The stone and the asphalt cement shall be heated separately to such a temperature as will give, after mixing, a binder mixture of the proper temperature for the materials employed. The stone when used must be at a temperature between 200 and 325 deg. F. The asphalt cement and stone shall be thoroughly mixed by machinery in such proportions that the resulting binder shall have life and gloss without an excess of asphalt cement and the mixing shall be continued until a homogeneous mixture is produced in which all the particles are thoroughly coated with asphalt cement. The finished binder must contain from 5 to 8 per cent. of bitumen and from 10 to 30 per cent. of material passing a 10-mesh screen, the percentage of bitumen to be regulated in accordance with the mesh composition and character of the mineral aggregate of the binder.

The binder mixture prepared in the manner above described shall be brought to the streets in wagons at a

temperature between 200 deg. F. and 325 deg. F. and shall be covered with canvas covers while in transit. The temperature of the binder mixture within these limits shall be regulated according to the temperature of the atmosphere and the working of the binder. On reaching the street it shall at once be dumped on the concrete and then be deposited roughly in place by means of hot shovels, after which it shall be uniformly spread by means of hot iron rakes and then at once be thoroughly compacted by tamping or rolling. The depth of the finished binder shall at no place be less than one or more than three inches and its upper surface shall be parallel to the surface of the pavement to be laid. All binder that shows lack of bond or an excess of asphalt cement, or that is in any way defective or which may become broken up before it is covered with wearing surface must be taken up and removed from the street and replaced by good material at the expense of the contractor. No more binder shall be laid at any one time than can be covered by two days' run of the paving plant on surface mixture. Binder when laid shall be followed and covered with wearing surface as soon as is practicable, in order to effect the most thorough bond between the binder and the wearing course. The binder course shall be kept as clean and as free from traffic as is possible under working conditions. If necessary it must be swept off immediately before laying the wearing surface upon it.

No binder shall be laid when, in the opinion of the engineer, the weather conditions are unsuitable or unless the concrete on which it is to be laid is dry and has set a sufficient length of time.

WEARING SURFACE.

The wearing surface shall be composed of sand, filler and asphalt cement of the character elsewhere herein specified and mixed in proper proportions. The sand and the asphalt cement shall be heated separately to such a temperature as will give, after mixing, a surface mixture of the proper temperature for the materials employed. The sand when used must be at a temperature between 250 deg. F. and 375 deg. F. The filler shall be added to the hot sand in the required proportions, and the two thoroughly mixed. The asphalt cement at the required temperature and in the proper proportions shall then be added and the mixing continued for at least one minute in a suitable apparatus until a homogeneous mixture is produced in which all the particles are thoroughly coated with asphalt cement. The weights of all materials entering into the composition of the wearing surface shall be verified in the presence of inspectors as often as may be required and the engineer or his representative shall have access to all parts of the plant at any time.

The surface mixture prepared in the manner above described shall be brought to the street in wagons at a temperature between 230 deg. F. and 350 deg. F. and shall be covered with canvas while in transit. The temperature of the surface mixture within these limits shall be regulated according to the temperature of the atmosphere and the working of the mixture. On reaching the street, it shall at once be dumped on a spot outside of the space on which it is to be spread. It shall then be deposited roughly in place by means of hot shovels, after which it shall be uniformly spread by means of hot iron rakes in such a manner that, after having received its final compression by rolling, the finished pavement shall conform to the established grade and have a thickness of not less than ..... inches. Before the surface mixture is placed all contact surfaces of curbs, manholes, etc., must be well painted with hot asphalt cement. The surface shall then be compressed by rolling or tamping, after which a small amount of cement shall be swept over it and it shall then be thoroughly compressed by a steam roller weighing not less than 200 pounds to the inch width of tread, the rolling being continued until a compression is obtained which is satisfactory to the engineer. Such portions of the completed pavement as are defective in finish, compression or composition or that do not comply in all respects with the requirements of these specifications, shall be taken up, removed and replaced with suitable material, properly laid, in accordance with these specifications, at the expense of the contractor. Whenever so ordered by the engineer, a space of twelve inches next the curb shall be coated with hot asphalt cement, which shall be ironed into the pavement with hot smoothing irons.

The finished pavement shall contain between 9 1-2 per cent. and 12 1-2 per cent. bitumen soluble in cold carbon disulphide, depending upon its mesh composition and the character of the sand used and the traffic to which it is to be subjected, but in all cases

sufficient asphalt cement must be used to properly coat all the particles of the mineral aggregate. It must also contain not less than 10 per cent. of mineral matter passing a 200-mesh sieve and not less than a combined total of 25 per cent. passing the 200, 100 and 80-mesh sieves. On streets of light traffic, when the engineer has approved the use of a coarser sand than that specified for general use, the surface mixture must contain not less than 6 per cent. of mineral matter passing a 200-mesh sieve and not less than a combined total of 18 per cent. passing the 200, 100 and 80-mesh sieves. The maximum amounts of 200, 100 and 80-mesh material in the pavement will be regulated according to the kind of sand and asphalt used and the traffic upon the street upon which the pavement is to be laid, subject to the maximum requirements elsewhere herein specified under Sand and Filler.

The above limits as to mesh composition and per cent. of bitumen are intended to provide for such permissible variations as may be rendered necessary by the raw materials used and the character of the work to be done. The composition of the wearing surface may be varied within the limits above specified at the discretion of the engineer, depending upon the kind of sand, filler and asphalt used and the traffic conditions upon the street or streets to be paved.

No wearing surface shall be laid when, in the opinion of the engineer, the weather conditions are unsuitable or unless the binder on which it is to be placed is dry. The finished pavement must be well protected from all traffic by suitable barricades until it is in proper condition for use.

CONDITION AT EXPIRATION OF GUARANTEE.

In addition to the proper maintenance of the pavement as provided for elsewhere herein, the contractor shall, at his own expense, just before the expiration of the guarantee period, make such repairs as may be ordered by the engineer and as may be necessary to produce a pavement which shall:

(a) Conform substantially in grade to the pavement as first laid.

(b) Be free from cracks more than three feet in length.

(c) Contain no disintegrated surface mixture.

(d) Not have been reduced in thickness more than 1-4 inch in any part.

(e) Have a foundation free from cracks or defects.

(f) Be in substantial accord with the specifications under which the pavement was laid, except as otherwise provided for in this section.

REPAIRING.

Whenever the repairs made at any one time shall amount to more than 50 per cent. of the surface of any one block the entire pavement of that block shall be taken up and relaid. These repairs, except as provided for below, shall in all cases be made by cutting out the defective binder and wearing surface down to the concrete and replacing them by new and freshly prepared binder and wearing surface made and laid in strict accordance with these specifications.

Whenever any defects are caused by the failure of the foundation, the pavement, including such foundation, shall be taken up and relaid with freshly prepared material, made and laid in strict accordance with these specifications.

The surface heater method of repairing may be used only in those cases where the repairs are not rendered necessary by:

(a) Failure of the concrete.

(b) Failure of the binder.

(c) Failure caused by the disintegration of the lower portion of the wearing surface.

Whenever the surface heater method is employed, all defective surface shall be removed before replacing it with new material. In all cases the old surface shall be removed to a depth of not less than 1-4 inch and the new surface mixture must, when compressed, be not less than 1-2 inch in thickness. The heat shall be applied in such a manner as not to injure the remaining pavement. All burnt and loose material shall at once be completely removed and while the remaining portion of the old pavement is still warm, shall be replaced by new and freshly prepared wearing surface made and laid in strict accordance with these specifications.

The Argument for State Highway Commissions*

By Logan Waller Page, Director of U. S. Office of Public Roads, Washington, D. C.

THERE are no better examples of high grade road construction than can be found today in the United States. It is equally true that the world possesses no better examples of poor maintenance. While construction is the first essential to road improvement, maintenance is of equal importance for the attainment of a perfect system, and, as a prerequisite to good maintenance, a thorough administrative system must be provided. While it is necessary that we devote immediate attention to the study of methods of construction to meet modern traffic conditions, and while the deliberations of great conventions will undoubtedly prove of real value, we should carefully guard against becoming too much absorbed in problems of construction to the neglect of the equally important problems of maintenance. The one point of clearly demonstrated superiority which the European road systems possess over our own is in their exceptionally effective administration and maintenance.

The whole subject of road improvement in the United States is today in a transition stage. We are not only endeavoring to meet the new conditions of traffic with new forms of construction, but our various state legislatures are actively engaged in an endeavor to meet the demand for road improvement by the enactment of suitable legislation and the appropriation of necessary funds. The fact that we are in this transition stage makes it not only opportune, but imperative, that our legislation be concise, practical and effective to the end that we may obtain and continuously maintain perfect systems of roads at the lowest possible cost. Although many of our states are appropriating large sums of money for the construction of new highways, yet few of them are making adequate provision and appropriation for the maintenance of these highways, the result being that roads are being constructed in short sections each year, to be worn out before continuous lines of road are completed. We now have a real and lasting opportunity to render a great public service by urging the adoption of those principles which have proven by long experience in other countries to be sound and effective.

The first and basic principle which underlies the most successful of European systems of road administration, and which is the basis of the most successful of our state systems in America, is centralization.

We have tried many expedients in America in the management of public roads, among them the toll road system which involves private control of a public utility. This is manifestly unsound in public enterprises, and it is a source of gratification that the toll road system has been largely abandoned throughout the country by the more progressive states, in favor of some system of public control and public expenditure. We have tried a system of public control through local units, involving the principle of extreme localization, in which the counties or their sub-divisions were made the unit of control, and this system unfortunately prevails today in approximately half of the states. Even in the states which have followed a progressive policy during the last few years, by far the larger portion of the roads is still under local control. This system is manifestly a failure, and we have found by careful investigation that the annual expenditure for road improvement in the United States is about $1.05 per capita, which on the present basis of population would be upwards of $95,000,000 a year. Our roads are admittedly the poorest to be found among any of the foremost nations, and the examples of roads commensurate with their expenditures are exceedingly rare. Besides, it is not merely a single county here and there throughout the state that should have improved roads, but continuous lines of improved roads should traverse the entire state.

The superiority of the centralized system over the system of local control is made more manifest when we compare the experience of England and France. The roads throughout England are almost uniformly excellent, but by reason of their lax system of local control, the cost of maintenance is very great. The annual expenditure for 1905 and 1906 was a lit-

* A paper before the National Good Roads Convention.

tle over $78,000,000, and, as the total mileage is slightly less than 150,000, it follows that the annual expenditure per mile was about $520. In comparison with this, the French roads, under a highly centralized system, are kept in a perfect state of repair at an average cost for the same period of about $244 per mile. A comparative analysis of the two systems reveals the cause of this marked difference in expenditure. The English system provides a large number of petty units, each under the control of an official independent of any central authority, in consequence of which uniformity of methods is impossible. While one official may conduct his work with skill and economy, it is scarcely reasonable to expect all of the officials to be equally efficient, consequently the saving in some of the units will be far more than offset by the waste in others. Furthermore, the incompetence of a large number of officials is more difficult to remedy than the incompetence of a single official. It is manifestly impossible for a small unit with limited revenues to secure the assistance, advice and supervision of a high-grade engineer, whereas in a centralized system the cost is so widely distributed as to constitute but a slight burden on each of the smaller units. In the purchase of supplies and equipment, a large saving can be effected by centralization, while in the reduction of personnel, and in standardization of methods and equipment still greater economy results.

In applying this principle to road administration in America, it must be apparent that the smallest unit for effective control is the state. Our own experience since the inauguration of the state-aid plan by New Jersey in 1891 has been uniformly in support of the wisdom of this contention. There has not been a single instance in which a state having once adopted in any measure the principle of state control and state aid has retrograded from its position. On the contrary, in almost every case increased power has continually been given to the highway departments of the states and larger appropriations granted. Not only has this been true, but it is a matter of common observation that the state roads throughout the country are far superior to the local roads, while in percentage of roads improved, the state-aid states are far in advance of those which are still adhering to the local system.

A particular phase of the centralization system which merits the fullest consideration is the tendency of the state aid system to build and maintain continuous trunk-line systems entirely at the expense of the state. State-aid legislation has followed in a large measure a process of evolution, the earlier laws being designed merely to give aid to the local sub-divisions. Later the principle of state control was emphasized in increasing measure, until today we have several examples of complete state supervision over definite lines of road. It is not only my hope, but belief, that every state will eventually adopt a system the most important essential of which will be the trunk line road supplemented by intercommunicating roads, in which a graduated system of state control will be exercised, and which will receive state-aid according to their importance.

I desire to call particular attention to the system prevailing in New York, which is the product of legislation extending over a period of 12 years, beginning in 1898. Until 1898, a system of extreme localization prevailed in New York. In that year, legislation was enacted providing that the small local units should receive a certain percentage of aid from the state, the amount depending upon the local expenditure. Thus the first step was far short of the highly centralized system now prevailing. In 1903 another step was taken when the legislature adopted a resolution proposing an amendment to the state constitution authorizing the issuance of $50,000,000 in state bonds for the building of state roads. This was ratified by the people in 1905, and the legislature of 1907 provided for a system of state aid which involved supervision by the state highway department, the state control, however, pertaining only to the roads built with the aid of state money. The tendency toward a more effective administration was apparent, however, in the appointment of a committee by the legislature in 1907 to undertake the revision of the state highway laws and propose a system. This report was adopted, and the new law became effective at the beginning of 1909. It provides for the construction of trunk lines to be built and maintained entirely at the cost of the state, and a tentative system was approved aggregating a length of about 2,800 miles. The county roads, comprising about 7,500 miles, are to be improved by the state, county and town jointly. The remainder of the roads, aggregating between 65,000 and

70,000 miles, are to be maintained and repaired by the towns with the aid of money appropriated by the state on condition that the local officials conform strictly to the methods specified by the state highway department.

This, in my opinion, constitutes an admirable arrangement, and the New York law, in my judgment, is today more nearly perfect than any of the state laws. Most important of all, New York has adopted a continuous system of repairs consisting of regular patrols, whose duty it is to maintain the roads at all times.

Summing up the advantage of state control of road improvements, we may confidently claim for the system that it makes practicable high grade, skilled supervision, as the funds will be adequate to employ the best men available. It should result in greater economy in both construction and maintenance, for the reason that a relatively smaller personnel will be required for administration and supervision, lower prices should be obtained in the purchase of equipment and materials; and a more accurate system of cost keeping and accounting is made possible. This system also should be productive of a far greater mileage of completed road, as it contemplates the construction of continuous lines of road rather than short, isolated stretches. To emphasize this point, we need only to recall an average instance of the distribution of county roads among various precincts. The distribution becomes so minute under the system of local control that the construction of any appreciable length of road is impossible. In consequence, even where short stretches of road are constructed, they may be said to begin nowhere and end nowhere, scarcely benefiting traffic, and, by reason of their location between stretches of unimproved roads, their proper maintenance is impracticable.

Aside from considerations of economy, we should not overlook the very important consideration that the expenditure of state funds tends to equalize the distribution of cost in a far more equitable manner than is possible under local control, for the reason that state revenues are derived from city and country as well as the large corporations, consequently, every interest in the state contributes to this important work of internal improvement.

Another point which I desire to emphasize as essential in any system adopted is, that skill and knowledge of road construction should be required of all officials having direct charge of road improvement. If we find it necessary to maintain technical schools for the training of military and naval officers, if in the states and counties we find it necessary to hold rigid examinations to test the fitness of teachers for our public schools, if the civil service system, which is generally approved in all units of government, is wise, why should we not require suitable qualifications on the part of the men who are to build and maintain our roads? If we turn to European precedents for light on the subject, we find that the two countries which are given credit for having the best road systems in the world, namely, France and Switzerland, require all of their highway engineers in public service to possess diplomas from the schools of roads and bridges maintained by the respective governments.

Several of the states have within the past few years enacted legislation providing for the appointment of a highway engineer in each county to have entire charge of road work. This is an excellent provision, and is exactly in line with the policy which I am advocating. The fact must not be overlooked, however, that there are some counties which can ill afford to pay a salary sufficient to secure a well qualified highway engineer. To meet this difficulty, the law should provide for the consolidation of several counties into a road improvement district, where it seems necessary, at the head of which should be placed a highway engineer whose salary and expenses would be borne proportionately by each county.

It is a matter of sound business to require that all our road taxes be paid in cash. The wisdom of this plan is so apparent as to need no vindication. The building and maintenance of roads is simply a great business enterprise conducted by the public. If a private enterprise could not succeed with its revenues partly paid in worthless labor and partly in cash, we have no right to assume that a public enterprise would succeed any better. Under normal conditions, I would most earnestly advocate the payment of all road taxes in cash, rather than in labor, but sometimes there are conditions which, in their relation to this subject, can scarcely be considered normal. I have in mind the problem throughout the South, where a large element of the population is capable of paying road taxes only in labor.

In those states, a change in the road laws relating to taxation for road purposes should only be made after a most careful consideration of these complex conditions.

In our eagerness to correct the evils in our existing systems of road administration we are apt to tear down faster than we can build up. I would, therefore, particularly urge that before we adopt sweeping legislative reform abolishing statute labor and toll roads, we make sure that we have a better substitute. I have in mind one or two instances where toll roads were abolished and no substitute provided, the result being that the road, which was poorly maintained before, received absolutely no maintenance after the law went in effect.

In dealing with the subject of actual maintenance aside from its administrative features, it must be evident that the only wise and safe plan is to provide, upon careful estimates, an actual cash appropriation sufficient to maintain every mile of new road that may be constructed, and at the same time provide a practical organization and a clear-cut, specific plan whereby this maintenance fund can be expended to the best advantage. It is necessary that the maintenance fund be kept absolutely separate and distinct from the construction fund, as otherwise the construction fund will be sure to borrow continuously from the maintenance fund and the intent of the law will be nullified. Continuous and systematic maintenance is the only solution of the maintenance problem. Damage to a road either from traffic or weather can be repaired at its inception with a slight expenditure of time and money, but if allowed to go without attention for a considerable length of time, will certainly involve great outlay for repair, and may even threaten the very existence of the road. The patrol system as practiced abroad and as established in the state of New York possesses many points of superiority over our usual practice of making repairs once or twice a year or when absolutely necessary. A distinction should be made between the continuous maintenance by the patrol system and extraordinary repair, such as failure of a bridge, culvert or a washout. An organization permitting of such repair should exist independently of the regular construction and maintenance forces.

The Office of Pubilc Roads has used its utmost endeavors to bring about the necessary reforms along these lines, as far as conditions have permitted. It is our endeavor to remedy the lack of knowledge of ordinary road construction in rural communities by sending out engineers to advise fully with the local officials and to give them the benefit of careful instruction in methods of construction and maintenance. These engineers are assigned upon the request of the local authorities, the entire expense of such assignments being defrayed from our appropriation. We are endeavoring to aid in some degree in providing skilled highway engineers to meet the demand by training every year in all branches of road work a small number of engineer graduates. The instruction given these young men is not gratuitous in the usual meaning of the word, as they render ample service in return for the instruction and the small compensation which they receive. We issue from time to time bulletins bearing upon various phases of road work, and when practicable, our engineers deliver lectures in local communities, in which they give information that will aid in solving the local road problems. Our investigative work is devoted to the various problems in connection with the construction and maintenance of roads, among the most important being the adaptation of methods of construction to meet modern traffic conditions. Another important project of an investigative character is comprised in our various experiments looking to the utilization of by-products in road building. Our laboratories also analyze and test road materials to determine their relative value and suitability for road constructions. This work is done free of charge for any citizen of the United States. A number of specialized projects arise from time to time through our study of road materials, which it is unnecessary to deal with in this paper.

In conclusion, I wish to state that if we are to accomplish these needed reforms, we can only do so through the medium of organized effort, and this organized effort should not be restricted to the holding of a few conventions here and there, but should include continuous and unremitting effort. I wish further to emphasize a point which I consider vital to the success of any great road organization, and that is that it should be built from the bottom up, or, in other words, that it should be composed of an aggregation of small local associations, which should be in intimate touch with local needs and problems, and which would give a national association a thoroughly representative personnel.

Top Soil Roads in Clarke County, Georgia

By Prof. C. M. Strahan, University of Georgia

THE methods followed in building the public roads of Clarke county, Georgia, which have spread to more than a score of other counties in the state, have given a new word to road literature, which, when rightly understood, will carry a new hope to many communities struggling with a meagre purse and impassable roads. Good roads have always been possible with limited mileage to be constructed and with pocketbook well filled. But a comprehensive system of good roads reaching the majority of the country landowners has seemed, and still seems, to many counties, a thing practically unattainable. The average Georgia county has four hundred miles of public highways and a taxable value of $4,000,000. An annual road expenditure of $20,000, calling for a tax levy of five mills, is a heavy tax, when added to the other demands upon the county treasury. Knowing that macadam and gravel roads cost from $3,000 to $9,000 per mile and require a maintenance cost of about $100 per mile, the rate of road building progress with this $20,000 (three to six miles per year) postpones for 25 years or more direct benefit to a large portion of the tax payers. Approached from the side of a bond issue, such a county, issuing $200,000 worth of road bonds, would virtually exhaust its constitutional borrowing power, would assume an annual debt for interest and sinking fund of nearly $20,000 and would build not more than 50 of its 400 miles of road in the macadam type. Weak counties are unwilling to assume such burdens. They do not feel safe in relying upon the increase of property values to reestablish the borrowing credit of the county. And, hence, road improvement lags.

If, however, a method of road construction can be found locally whose cost does not exceed $1,000 per mile, and whose results are reasonably efficient, as shown by the satisfaction of the public and a low maintenance after construction, the problem takes on a different aspect. Either by bonds or by yearly revenue it becomes possible to complete a large mileage in ten or fifteen years and the benefits are widely felt throughout the entire county.

The top-soil roads of Clarke county are of this class and are the outcome of a situation somewhat similar to that outlined above. They were begun in direct answer to popular discontent with the slow progress and very limited mileage of macadam roads which could be secured with $100,000 of bonds. When about half of the bond money had been spent on macadam construction and when only eight miles of road had been built, the change of program was inaugurated.

Mr. W. S. Holman, the superintendent, made this argument to himself. Many stretches of road, where the top layer of soil had not been disturbed, remained in good condition at all times. Frequently such stretches showed very little wear after a century of use and were still nearly flush with the adjoining fields. Why would not the top soil from the field near by, if spread upon the roadbed, pack down into a firm, smooth, water-resisting and durable surface coat? He had the courage to answer this question by ample experiment and to the full satisfaction of the public during four years past. The answer is now spread out over Clarke county in 60 miles of highway, broadened to 30 feet and surfaced 10 inches deep and 16 feet wide, with selected top soil as the wearing coat. The cost of placing, consolidating and shaping this wearing coat, using convict labor, has averaged $500 per mile. The entire cost of the roads, including much heavy grading and ample permanent drainage, has been $1,000 per mile. As engineer of the county, the writer has been in close touch with this type of construction and has aided in every way its development as experience has modified our practice. A laboratory for the examination of top soils has been equipped and a large number of samples examined, both before and after using the material in construction. With four years' experience, with much success and with no failures, with a surprisingly low maintenance cost, with complete freedom from mud after repeated rains and alternate thaws and freezes, the writer does not hesitate to endorse the methods now in use and to give them publicity for the benefit of other sections of the country where similar top soil may often be found if intelligently sought out.

Our procedure in building a top-soil road is briefly this:

1. The road-bed is staked out and graded thirty feet wide under the engineer's plan and culverts are put in place. A four per cent. maximum grade is adopted on the main roads. Rarely, short stretches of six per cent. have been left. The bed is made level transversely but not specially dressed to exact surface.

2. Suitable top-soil is selected near by from open fields and purchased from the landowner. This is loosened to a depth of eight or ten inches and is spread upon the road-bed in a single layer ten inches thick and preferably twenty feet wide. Earlier practice used only sixteen feet width and a final crown of one inch per foot. The present crowning is about five-eighths inch per foot.

3. With the road machine, flat side ditches are excavated six inches deep and the earth is thrown against the top-soil as a shoulder.

4. The consolidation is effected by the passage of the construction teams and by the traffic. The top-soiling follows behind the grading, and is kept within a convenient distance. It is not necessary to wait for embankments to settle before applying the top-soil. In fact, should rainy weather come, the top-soil packs promptly and prevents the traffic from miring in the freshly made fill. Any disturbance of grade alignment is corrected by hauling in additional top-soil. The consolidation by the traffic is, of course, gradual; and as the center packs down, the road machine is used to pull the sides inward and establish a smooth crown. In the course of six weeks or two months, a firm surface is perfected, which is so hard that the road machine will not cut it. Hence the importance of frequent dressing by the machine during the packing period and particularly after rains when the top-soil is moist.

5. Where the sub-soil material is weak and slippery and highly charged with mica, the top-soil layer is thickened to fourteen inches. No attempt is made to use rollers in consolidating the surface. The cost would be considerable and the amount of compression per inch width is not as great as from horses' hoofs and wagon tires.

The most vital point in the above process is to secure a suitable top-soil. What is a suitable top-soil?

1. It is the top-layer of soil on a cultivated field (or one formerly in cultivation) which has been intermixed and pulverized and exposed to the action of the weather and of plant life. Usually it shows the results of this action in being bleached out and is of a different consistency from the sub-soil below.

2. It must be a mixture of clay and sand or gravel. Rocks more than two inches in diameter should be shoveled aside in loading, or discarded when dressing the road. Very fine sand is objectionable. Samples separated in a nest of six sieves (graded from ten to one hundred mesh) which show much fine sand below the forty-mesh sieve should be rejected, as they will usually be deficient in clay. The coarse sand and gravel should be at least fifty per cent. of the mass, and of hard, tough consistency, not readily crushed by traffic. Mica in any considerable quantity seriously damages the soil for road purposes. Soft, black soils with large amounts of humus are entirely unsuitable. When separated by pulverizing and sifting, the contents of the finer sieves, when mixed with water, should give a sticky, smooth ball of nearly pure clay.

3. It must be found close to the new road—i. e., within a one mile haul of the place where it is to be used. Otherwise, the cost of hauling becomes very much increased, and the rate of progress is largely decreased, much to the public's discontent. A less valuable top-soil, with short haul, is preferable at the start to a better top-soil two miles or more away. However, when a reasonably good surface has been once formed with the near-by top soil, it will be feasible to haul large loads of the better top-soil over longer distances, with which to make a second more durable, wearing coat at small cost. This second coat can be, and is, put on in connection with the work of maintenance.

It will be noted at once that the top-soil road, as described, is a variation of what is widely known as the sand-clay road. It is virtually, as used in Clarke County, a semi-gravel road with clay binder. It differs from the artificial sand-clay road in this respect, viz., that in the top-soil the sand and clay are obtained in a state of intimate mixture and will consolidate at once when put in place. The artificial mixtures of sand and clay require either much time for the traffic to puddle them, or the expensive use of harrow, plows, and watering cart to bring them to suitable condition. Moreover, the pulverizing of the clay and its exposure to the weather and to vegetable action seem to influence strongly

PUBLIC COMFORT STATION, BROOKLINE, MASS.
I. Station is Underground in Front of the Fire Station in Center of the View.

its binding power. Once consolidated, the top-soil road no longer absorbs water, nor softens. Its surface is most perfect immediately after rain. Dry weather develops some dust but not in excess. The thick ten-inch bed is recommended in order that the traffic may not cut through into the softer foundation and allow ample material for wear.

While the name "top-soil roads" is not a scientific one, the writer justifies it as a term which really describes the surface material. He knows that top-soils of equal value are found with great differences in color and derived from quite different rock origins; that various semi-gravels of great road value abound in many counties throughout Georgia from the metamorphic areas down through Columbia Sands and Altamaha Grit; that similar soils with large content of coarse sand or gravel exist in the Carolinas, Tennessee, Kentucky and Virginia. He believes that the binding and waterproof quality of the clay is the result of pulverization and vegetable action. Hence no specific geologic name would so fitly embody the broad distribution and the special processes which the top-soil suitable for road building has undergone. As the result of investigations now in progress, it may be possible in the near future to systematize the clays and rock systems from which good road soil may be expected. Fortunately, the name top-soil road carries a valuable note of encouragement. Top-soils of some sort are found everywhere. It may be that many readers of this article will recall local soils of promising character and bring them to the attention of the road authorities in reach. Nothing wiser can be done by any community than to investigate the local possibilities for top-soil road construction. Even where the main roads are already built of a more expensive type, the secondary roads need betterment and can often find it by following up the top-soil idea.

This article would fall far short of its object unless it presented some concrete evidence of the acceptability and durability of the top-soil road. A recent Round-the-State-Tour of Georgia of more than a thousand miles was made in the interest of the road movement by seventy-five automobiles carrying three hundred people under the auspices of the Atlanta Constitution. That party found the best roads in Clarke County of North Georgia and in Sumter County of Middle Georgia. In both counties the roads are of top-soil construction. But the taxpayer's opinion is perhaps the best barometer. The last grand jury voices its belief that Clarke County has secured the best roads at least cost of any county in the state; and, now that the original bond money is exhausted, encourages the Road Commissioners to continue the top-soil program by increased direct taxation.

Four years ago, the writer, as an engineer, would have had serious doubt of road construction as herein presented. Today he has abundant confidence. He has seen important highways with relatively large rural traffic stand up for three years in all weathers with no mud and with a repair account less than $25 per mile. He has seen this top-soil surface maintain itself on grades as high as six per cent.; and he is familiar with long stretches of road where the motor cars are jocularly advised to slow down to ninety miles per hour. Where such roads can be surfaced for $500 per mile and maintained annually at less than $25 per mile, there is hope for good roads for every farmer and the poorest county or township can at least make a start.

Two Public Comfort Stations

SINCE the completion of the public comfort station in Indianapolis in July of this year a great deal of comment has been heard regarding the principles of its construction. The greater part of the criticism directed towards it deait with the fact that it was neither of the above ground nor under ground type, but seemed to be a combination of the two. One individual was heard to remark that it was "all buried but the ventilating tower and it was left to stand out like a sore thumb.."

The public comfort station of Brookline, Massachusetts, was given as an example of the proper construction for an underground type of station.

As will be seen from the accompanying photograph, the Brookline station is entirely under the surface. The ground over it and adjoining has been

PUBLIC COMFORT STATION, BROOKLINE, MASS.
II. Retiring Room, Women's Section,

planted with shrubbery so as almost to conceal the station. The structure is built of reinforced concrete, the walls and roof being waterproofed by a heavy coat of roofers' pitch and with 5 layers of roofers' felt combined with hot pitch for a distance of 2 feet below the roof and by the use of 3 layers of felt to a level of 4 feet below the roof. The floor is placed 9 feet below the walk; the ceiling is 8.5 feet high and the roof is covered with 2 to 3 feet of loam.

On account of its non-absorbent characted and freedom from stain, gray Tennessee marble was used for the water closet partitions, urinal stalls and wainscoting, the height being 6½ ft. in the case of the water closets and 6 ft. elsewhere. White vitreous 3-in. x 3-in. x ½-in. tiles were used in the main rooms on account of their non-absorbent character and great durability.

A central compartment is provided in which all service pipes, flush boxes, soil pipes, etc., are located. This compartment is shown near the center of the floor plan given herewith. It allows access to make all plumbing repairs and provides ample protection against freezing of pipes.

The building is heated from the hot water system in the fire station plant, only 10 to 15 feet away, and is designed on the basis of 1 sq. ft. of radiation for each 40 cu. ft. of space to be warmed. In addition to this, a 9-ft. radiator is placed in each light shaft to aid in the warming and to keep the snow melted in winter.

A system of ventilation has been adopted, consisting of an electrically-operated fan placed in the pipe chamber near the ventilation shaft, with ducts leading to each closet and urinal, so that the air in the station can be exhausted through these fixtures at the rate of once in 15 minutes. It is believed that this will be ample to keep the air good under the worst weather conditions.

The station is well lighted during the day with six light shafts arranged as shown, in which are placed 2¾-in. luxfer prism sidewalk lights, spaced 4 in. on centers. During dull weather and at night it is lighted by electric lights controlled by suitably arranged switches.

The essential features of design of the Indianapolis station are very similar to those of the Brookline sanitary. The similarity of the floor plan arrangement may be noted from a comparison of the two drawings shown.

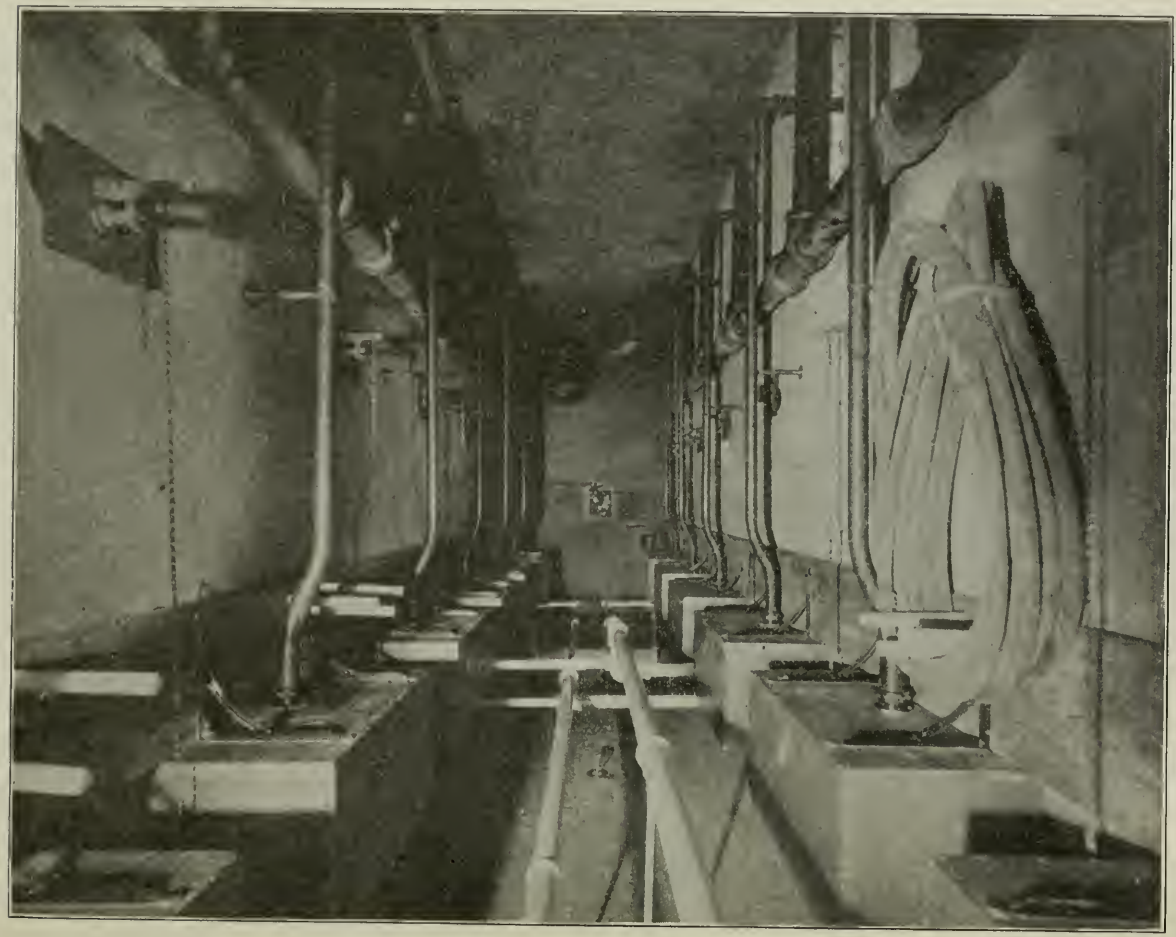
In the Indianapolis station double circular stairways at either end lead down to the floor level of the station. Between these stairways is an attendant's room, which on the women's side is furnished with a couch and benches. As in the Brookline station, a central compartment was provided for all flush tanks, pipes, the hot water heating tank and sewer pipes. With these features noted all similarity ceases, and the two differ in many details.

A number of questions other than those of architectural beauty, ease of of access and stable construction, influenced the planning of the Indianapolis public comfort station. An 8-ft. main trunk sewer down the center of Kentucky avenue follows the long axis of the station at a depth of only about nine feet. This necessitated the building of a portion of the station above the street line. The roof was placed at a height of about 3½ feet above the level of the street in order to discourage any inclination to sit upon it, and a narrow curbing nine inches in height was placed around the base so as to act as a buffer should vehicles come too close to the wall. Even with the raising of the structure it was necessary to remove about a foot from the top of the sewer and support the floor of the station on a grillage of I-beams placed transversely and supported on footings at the ends. On account of this location immediately over the top of the sewer, it was necessary to place all the toilets on a concrete platform nine inches above the floor level and to connect them to the soil pipe by means of a pipe from the back of the fixture instead of from the bottom.

A network of heat pipes, wire conduits, water lines, etc., made it necessary to construct the wing to one side of the center only. The roof over this wing and supporting the pavement on the west side of Kentucky avenue is formed of I-beams with arches of brick between. It was designed to support a 20-ton roller.

The walls throughout are of brick, varying in thickness from 18 inches to 2 feet and 6 inches. They were waterproofed with R. I. W. dampproof applied to the outer side. The inner side is lined with hollow brick and glazed white tile. The floors and roof are of concrete, the latter waterproofed with elastic paint.

The plumbing fixtures are of the latest approved type, white enamel, nickeled brass and marble being



PUBLIC COMFORT STATION, BROOKLINE, MASS.
III. Pipe-Chamber, Showing Piping for Water Supply.

used. All soil pipes have screw joints instead of being calked.

The pay closets, shown along the outer wall, are equipped with porcelain fixtures, including a wash basin, with hot and cold water, and a mirror, towels, liquid soap and a comb and brush are supplied in each of these compartments.

The ventilation is very good, particularly so in view of the location partially below ground level. A 20-in. tile pipe leads the air from the bottom of the stairs through to the side wall ventilators placed near the wall farthest from the source of outlet. A motor-driven disk fan, placed in the top of the ventilating tower shown in the photograph, draws the air through wall ventilators suitably placed. A separate hooded ventilator is placed back of each toilet fixture. Ventilators are also placed over each of the soiled linen closets. The building is heated by the Merchants Heat and Light Company, raditors being placed so as to occupy a minimum of available floor space.

The station complete cost slightly in excess of $17,000. It is under the care of one woman and one man attendant, and is open from 7:30 in the morning until 11:30 at night.

In comparing the two stations above noted it will be conceded from the success of the Brookline sanitary, now over a year old, that the underground type is more desirable. It may be adapted to use on downtown streets, space being required only for the entrances, and a treatment such as that of Brookline's station allows of greater privacy and less obstruction of traffic.

The central compartment for the plumbing fixtures is a point of value possessed by both the structures. Heating, ventilating and lighting facilities are excellent in both; as are the arrangements of the attendants' rooms, retiring rooms, etc. The one point of superiority which the Indianapolis station may claim is in the more recent type of fixtures adopted and the greater natural lighting facilities.

Since the Indianapolis station could not be placed entirely underground, the question arises as to why it should not have been put at or near the ground level, thus still further improving the lighting and ventilating facilities, reducing or eliminating entirely the steps to be climbed, and obviating the possible obstruction of flow of water in the sewer.

Indebtedness for pictures and plans is acknowledged to the *Journal of the Association of Engineering Societies* for the Boston Society of Engineers, to *Domestic Engineering*, and to Herbert W. Foltz and Wilson B. Parker, the architects of the Indianapolis station.

Some Provisions in Modern Franchises for Municipal Service Utilities*

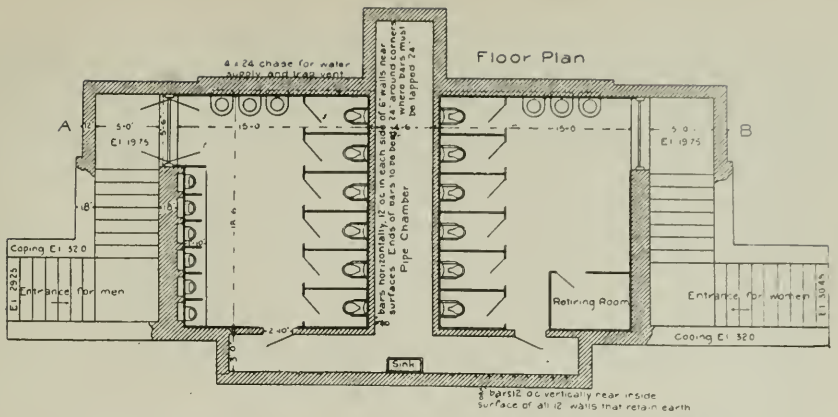
By Charles Carroll Brown, Consulting Engineer, Indianapolis, Ind.

THE states of the union are gradually adopting the principle of expert supervision of the formation and operation of public service corporations by state boards, for the almost uniformly satisfactory service rendered by those which have been established has demonstrated the practicability of the plan, and notable success in some states has shown that it is possible in practice to approach complete satisfaction to those satisfied with legitimately liberal returns.

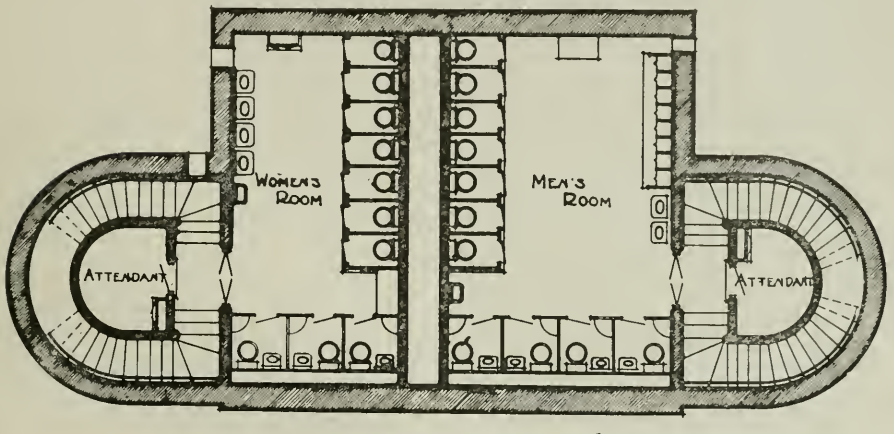
The influence of the work of the state public service commissions in the few states in which they have been established has been felt throughout the country, and in states not so favored this has been shown by the improved form of certain provisions in ordinances granting franchises to local service corporations.

The character of some of these provisions will be illustrated in this paper by quotations from two franchises recently granted, one of them after consultation with the writer and the other with the aid of William H. Bryan. While these provisions are not extensive they are advances and are signs of the course the advance is taking. The first is an ordinance which has been accepted by the Taylorville Railway, Light, Heat and Power Company and under which it is at present operating. A similar ordinance, varying

*A paper before the American Society of Municipal Improvement.



IV. PLAN FOR PUBLIC COMFORT STATION, BROOKLINE, MASS.



V. PLAN FOR PUBLIC COMFORT STATION, INDIANAPOLIS, IND.

VI. END VIEW OF PUBLIC COMFORT STATION, INDIANAPOLIS, IND.

only in details to conform with differences in condition is now under discussion between the city of Taylorville, Ill., and the Taylorville Gas and Electric Company, the principal point of difference being the rate proposed for the supply of gas.

The ordinance now in force grants the Taylorville Light, Heat and Power Company the right to construct overhead and conduit lines for the distribution of electricity in certain streets for which petitions of the residents have been received, and also the right to lay pipes in all streets for the distribution of steam for heating purposes.

The character and mode of maintenance of poles, wires, pipes, conduits, cables, etc., are prescribed, also the quality and sufficiency of all machinery, materials and workmanship, restoration and repair of streets, conformity to future improvements, etc. Rates are prescribed, and it is provided that the rates shall be the same for the same amount of service to all consumers, and that the lighting service shall be metered if the consumer so requests. Special contracts for heating schools and auditoriums of all sorts are provided for. Form and method of presentation of bills is prescribed, also testing of light meters and fee therefor. The late special session of the Illinois state legislature established an optional commission form of city government, which, when adopted by a city, prohibits discriminations in rates for any purpose or to any cunsumer unless expressly authorized by enumeration in a city ordinance. The following section is of particular interest:

"Section 12. Either party shall have the right to have either or all of the above and foregoing rates revised and determined after sixty days' notice to the other, but not oftener than once in five years, during the existence of this grant, but it is expressly agreed that no changes in the maximum rates hereinbefore established or to be hereafter established shall be made by said company, without the consent of the city council of the city of Taylorville, expressed by ordinance duly passed and approved, and no changes shall be made as herein provided until after a period of five years.

"If either party shall give notice as herein provided for a change in the maximum rates and the said city of Taylorville and the said company fail to agree upon what shall be taken and held to be a proper maximum charge for electric current for light, heat and power, or steam heat, or either of them, the same shall be submitted to a board of engineers consisting of three disinterested electrical engineers, to be selected by the city and by the company, in such manner as may be mutually agreed upon, but no one of whom shall be considered, nor be a representative of the interests of either the city or the company, which said board of arbitration shall investigate the question of the reasonableness of the charges contained in said notice, and make a report thereof to the city council and said company, which said report shall be binding upon the parties thereto, as to the reasonableness of the charges submitted to such board for investigation and report.

"And should such board find that a change should be made in such maximum charge or either or any of them, the city council shall, by proper ordinance, fix the maximum charge for electric current for light, heat or power or steam heat, or any or either of them, as found by said board of arbitration, which said maximum charge for such electric current and steam heat shall be and remain the maximum charge for such electric current and steam heat, for the period of five years next succeeding, and until it is changed as herein provided, and the costs and expenses of such arbitration shall be borne in equal parts by the said company and the said city of Taylorville. And both the city and said company shall render such aid and assistance to said board of arbitration as they require to enable them to reach a decision with regard to the rate or rates under consideration.

"Provided, however, that such board of arbitration shall not take into consideration the value of any franchise granted by the city of Taylorville to said company, or to any person, persons, company or corporation, and owned or controlled by said Taylorville Railway, Light, Heat and Power Company, its successors or assigns, in considering the reasonableness of the rates charged by said company."

It is provided that the company shall furnish free current for lighting the public library, city hall, fire department building and water works pumping station, and street lines therefor, the city to furnish the fixtures within the buildings, also space on poles and in conduits for city fire and police alarms and telephones, which use is non-transferable. A street lighting contract is also included, fixing rates and measure of quality for such service.

The franchise is not exclusive. It includes the usual clauses indemnifying the city for all sorts of damages from construction, operation and maintenance, and forms of bond therefor and for failures in service, or other violations of the terms of the franchise.

It is also provided that there shall be no assignment or transfer of the franchise to any one else engaged in the same business in the city. The term of the franchise, in accordance with Illinois law, is twenty years, at which time the company is required to remove its poles, wires, etc., from the streets, unless a new franchise is granted by the city council.

The other franchise referred to is one for the water works of Mexico, Mo. This franchise is also for a term of twenty years. It provides for a system of water mains as shown on an official map, for furnishing water for the citizens through the mains, for water for fire protection through seventy-eight fire hydrants to be paid for at the total rate of $3,120.00 a year, for future additional hydrants at $50.00 a year each, for additional intermediate hydrants at the cost of furnishing and moving them, for reservoirs and wells and purification of water, for a water tower, buildings and machinery, extensions of mains, fire streams, rates, telephones and fire alarms. The city is given water free for its public offices, a hose house, seven public drinking fountains for man and beast and one in a park and for flushing sewers, each flush tank to discharge not oftener than four times in twenty-four hours. The ordinance contains the following provisions of special interest:

"Section 15.—Failure of Supply. If at any time the supply of water as hereinbefore stipulated is shut off from any cause whatever (except through the fault of the city) the rental of the fire hydrants shall cease during such suspension. If at any time the grantee shall fail (except through unavoidable accident, or providential hindrance) to furnish an adequate supply and quality of water as provided in this ordinance, the city may impose such reasonable penalties as it may deem the situation justifies, such penalties, however, to be subject, on the grantee's demand, to review in the courts before enforcement.

Section 17.—Purchase by City. The city shall have the right to acquire by purchase all the property of the grantee actually used and useful for the convenience of the public, at any time after the expiration of fifteen (15) years from the passage and approval of this ordinance by public vote, upon giving one year's notice to the grantee, and upon paying therefor in cash the then cost of duplication, less depreciation, of said property, with ten per cent. additional thereto as compensation for earning power, franchise value, going value, contingencies, and all other intangible values of every nature whatsoever. If the grantee and the city should not be able to agree upon the cost of said duplication, less depreciation, they shall select a disinterested and competent appraiser to make such valuation. If the said parties cannot agree upon such appraiser, then the city shall select one appraiser, and the grantee shall select another appraiser and the two appraisers so selected shall make the valuation. If they cannot agree upon such valuation, then they are to select a third appraiser, and if they cannot agree upon a third appraiser, said third appraiser shall be selected by the judge of the circuit court of Audrain county, Missouri. Thereupon the appraiser, or appraisers, so selected shall ascertain by majority vote the then cost of duplicating said property, less depreciation. Such appraisal shall be binding upon both parties, and the city shall thereupon have the right to purchase the said property at such appraised value, plus ten per cent., as above stipulated."

It is, of course, impossible for a city council in an ordinance of this nature to produce the same effect which it is possible for a state public service commission to produce in the regulation of service and of rates, but the Taylorville ordinance makes a strong effort in this direction, and if it will call to its aid experts who can determine the reasons for failures of the company to fulfill its obligations and the best methods of making the necessary improvements, it can go far toward keeping an unwilling company within bounds. There is no ambiguity regarding the character, quality and amount of service required, so that a company intending to give good service knows exactly what is required of it. The only penalty provided for failure to comply with the terms of the ordinance, other than assessment of damages arising from construction or operation, is revocation of the franchise, a step so serious that it will scarcely be taken unless the company is extremely derelict in the performance of its duties.

The provision for revision of rates,

quoted in full above, is a step in the right direction, but has one or two rather serious defects. One of these may prevent the revision. If the parties fail to agree upon a method of appointing the board of engineers there is no method of forcing the submission of the question to such a board or of securing its appointment. The party objecting to a change of rates can thus defeat the revision by simply refusing to agree to any proposition for the appointment of the board. It is questionable whether the restriction of the membership in the board to electrical engineers is wise unless the term is construed in a rather large sense and may be considered to include competent engineers or others with sufficient knowledge of the electrical problems involved to make them available for the service. Most of the questions involved are not, strictly speaking, within the province of the electrical engineer, as such, although their application to the work in hand may require some knowledge of the technique of electric lighting practice. The provisions governing the appointment of the appraisement board for the sale of the water works plant at Mexico, quoted in full above, are more completely applicable, so far, at least, as the method of appointment is concerned. It remains to be seen whether the provision requiring both city and company to furnish such aid to the board of engineers as they may require will give them the authority to call for books and records enough to get the complete knowledge of the plant and its operation which is necessary if the most equitable rates are to be determined.

It is interesting to compare the provisions in the two ordinances regarding intangible values. The Taylorville ordinance provides that no allowance shall be made for the value of the franchise in determining the reasonableness of the rates changed by the company. The Mexico ordinance combines earning power, franchise, going value and contingencies in one item, which it arbitrarily fixes at ten per cent. of the cost of duplication of the plant, less depreciation. In these items are usually found the excuses for excessive capitalization, the preliminary estimates of value of franchise, growth of business and the like, giving color, from the promoter's standpoint, to the issue of capital stock to represent them. Franchise value without doubt belongs to the community whose growth gives the value and the increase in value which is so large a part of the promoter's stock in trade. Going value and earning power depend upon the competence of the management and upon its ability to take advantage of all the opportunities to develop business. They may very properly be considered as belonging to the company and, if their values can be determined, they should be credited to the company. The process of determination of these values is one requiring the most expert investigators, which very few cities, and practically no small cities, can afford to employ, even if the officials know where to find them "with no strings to them." The Mexico franchise solves the difficulty by fixing definitely the percentage to be allowed for them all. The Taylorville franchise reduces one very properly to zero and leaves the determination of the others to the board of engineers. This is one reason for doubting the propriety of excluding from that board experts on the financial side of the question because they cannot be classed strictly as "electrical engineers."

The Taylorville franchise provides no definite method of determining the extent of violations of the contract included therein. The Mexico franchise provides, as quoted above, for reference of the matter to the courts in case the imposition of penalties by the city for violations is considered by the company to be unjust.

These franchises have the advantage over the one presented for discussion last year in that they are both in operation. They contain some of the same provisions. That form of franchise was accepted by the most interested party, the company, but was not adopted by the city council, mainly for reasons not connected with the technical features of the franchise. It carries these modern phases of franchise building still farther than the examples here quoted. Reference may be made to the paper by the author on "A Modern Franchise for a Public Service Corporation" in the proceedings of the society for 1909.

The best such franchise is, however, merely a substitute, it is to be hoped for temporary use, for control by a state public service commission. Legislatures have found it necessary to limit the period of franchises to 20, 25 or other longer periods of years because they were confessedly unsatisfactory and there seemed to be no other way of holding them in check. Such limitation for a business which is by nature continuing is wasteful, and results in rates high enough to

pay, not only the legitimate charges for operation, maintenance, interest, etc., but also an additional sum to equal the risk that the plant must be abandoned when the franchise period has expired. The state commission is able to get around this difficulty if it has the power to grant permits for operation of franchises for indefinite periods, during good behavior, or until conditions so change that changes in the terms of the franchises must be made. It would be a very exceptional city which could undertake the same procedure. No cities except the largest have the experts necessary to establish a public service commission in every city, as was proposed in the bill offered in the Illinois legislature last winter. Fortunately these provisions were cut out of the "Commission Form" law which was passed. The state can employ these experts and keep them sufficiently employed in the oversight of the public service corporations in the state to retain them permanently in its service. The state commission is more nearly independent of local conditions than any commission appointed by the local authorities can be. It owes no allegiance to either party. The state commission is therefore the logical result of the agitation for more thorough supervision of public services, whether operated by municipality or by private company. Until a state has such a commission it cannot expect to secure much better results than can be attained under such a franchise as that granted by Taylorville.

The Municipal Lighting Plant at Bellefontaine, Ohio

THERE are several cities, notably of the west or middle west, that own one or more of their public utilities. Bellefontaine, Ohio, has the distinction of owning and operating an electric light plant, a gas works, and a water works; all three being under the management of the mayor and board of control. Of the public utilities mentioned, the electric plant presents more features of interest because of the fact that it is now meeting problems of great concern to all municipal lighting plants, and for the reason that its power equipment is a demonstration of a type of unit comparatively unknown in municipal lighting.

As is usually the custom where municipal ownership is comparatively untried, Bellefontaine in making provision for the accounting system of the plant did not fix any charge for street and public lighting. This fact makes it exceedingly difficult to arrive at a definite conclusion concerning the financial success of the plant entire. The cost of the power station, including engines, generators, switchboard, foundations and auxiliaries, was $44,000 at the time of completion in May, 1906. The cost of reconstruction of the transmission line and of 150 street arcs brought the entire first cost to about $60,000.

The following is the annual report for the year 1909:

EARNINGS.

From incandescent lighting		$10,953.61
From power service		1,821.60
From public service (estimated)		13,925.52
Total		$26,700.73

DISBURSEMENTS.

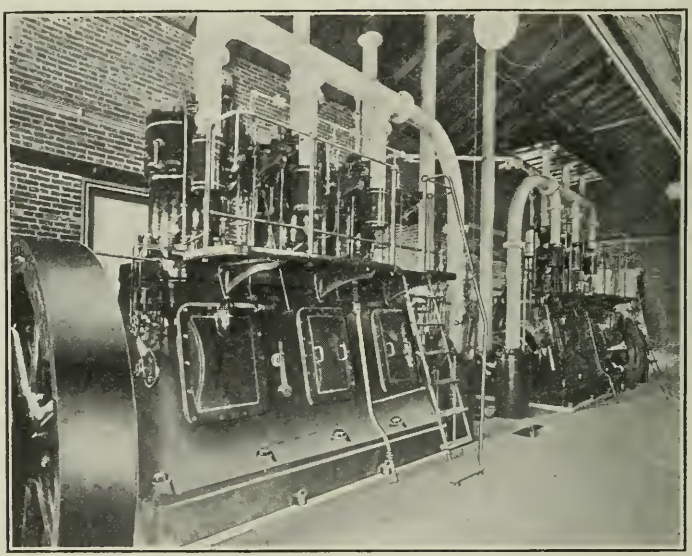
Fuel oil	$1,850.07	
Waste, packing and supplies	39.31	
Engineers	2,100.60	
Expense of machinery	1,182.05	
Extra labor	28.84	
General expense of manufacture	54.13	
Total expense of manufacture		$5,255.00
Insurance		15.00
Carbons	$207.89	
Attendance	730.42	
General expense and labor	414.93	
Expense of public service	$1,353.24	
Carbons	$25.21	
Attendance	78.35	
General expense and labor	702.75	
Total expense commercial service	$806.31	
Total expense of distribution		2,159.55
Poles, lamps and wire	$179.45	
General expense and labor of construction	30.37	
New public service	$209.82	
Poles, lamps and wire	$454.44	

Transformers and meters	1,560.26	
General expense and labor of construction	132.27	
Appliances and tools.	11.25	
New commercial service	$2,158.22	
Extension to building	$75.00	
Paid board of sinking fund trustees for redemption of bonds	3,000.00	
Total capital account		$5,443.04
Total disbursements for year	$12,872.59	

these two gives a total of $12,775.21. The earning capacity of the plant and its success as a municipal venture can not be arrived at definitely from this, but figures are available which show the economy of operation of the power factors.

The power plant equipment includes two 225 h. p. Diesel oil engines of a speed of 164 r. p. m., and two direct connected 150 kw. a. c. generators. An accompanying photograph shows the installation.

The Diesel engines are radically different from other types and are perhaps not sufficiently familiar to be



OIL ENGINES IN MUNICIPAL ELECTRIC LIGHT PLANT,
Bellefontaine, Ohio.

Total receipts for year		$12,641.05
Balance in treasury Jan. 1, 1909		2,426.26
Balance in treasury Jan. 1, 1910	2,194.72	
	$15,067.31	$15,067.31

Number of customers.....345
Gained during year.....60
Number meters, both power and light.339

As will be noted, the item "Public Service" under earnings is merely estimated, and the basis on which this estimate is made is not given, so that the information is of little value. Then under the caption "Total Receipts for the Year" the amount, $12,641.05, is given without any information as to its source. It is evidently not derived from the earnings from the two sources "From Incandescent Lightning" and "From Power Service," for the sum of

passed by without further comment. They are three-cylinder units, of the vertical enclosed-crank-case type, direct-connected to the generators. Their method of operation distinguishes them from all other types of engines. Air is admitted into the cylinder and compressed to a pre-determined pressure, which will give a temperature above the firing point of the fuel. The fuel (either crude or fuel oil) is then blown by air from a separate compressor into the cylinder at the time when the compression is complete. This spray of fuel is ignited by the highly-heated air within the cylinder and burns steadily with no essential rise in temperature. The resulting impulse delivered to the piston is therefore steadily applied and is not delivered with a shock, as is the case

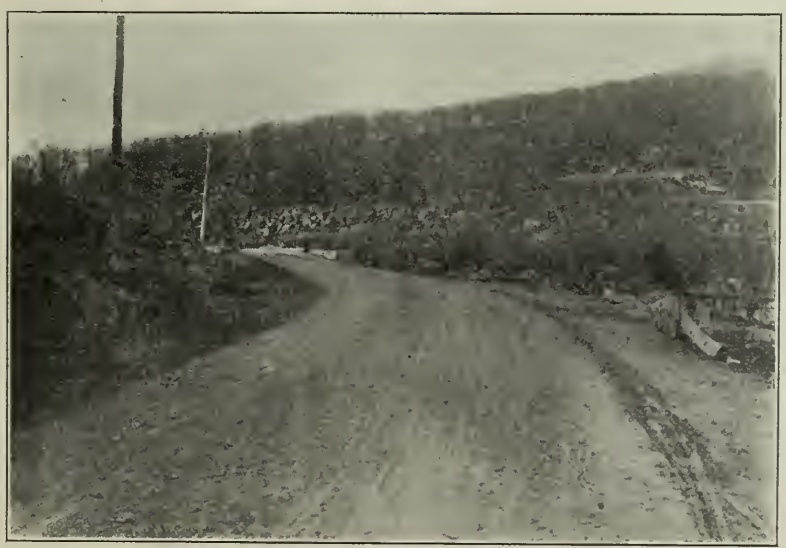
with most methods of ignition in internal combustion engines.

The air compressor is of standard construction, and can be driven by the engine or by separate power. It serves only to pump the air for oil injection and to store a surplus in tanks for starting the engine when cold. A small pump, mounted on the engine, lifts the fuel into the atomizing chamber in quantities regulated by the governor, which proportions the fuel supply to the load. The lubrication of all parts within the crank-case is taken care of by oil splashed over them by the revolution of the crank webs. A forced-feed oiler and a few cups complete the system.

The two engines described have been in service in Bellefontaine continuously since May, 1906. From that time until March 1, 1910, the saving in fuel alone, estimating the coal consumption at 9 pounds per kw. hour, has been $29,500; while the maintenance expenses have been very light and the entire power-house force required was three men (one night engineer, one day engineer and one helper, who also trims the lamps).

As will be seen from the annual report given above, the total disbursements for production, including fuel, maintenance, repairs, labor, etc., amounted in 1909 to $5,255. The total kilowatt output was 645,740 kw. hours, so that even with the items above noted the cost of production was only about 4/5 of a cent per kw. hour service delivered. The total amount of fuel oil consumed was 755,281 gallons. The cost of fuel oil was only $1,850.07, or 0.28 of a cent per kilowatt hour on switch board.

The Bellefontaine plant presents many features of interest to one interested in municipal ownership, and it is to be regretted that full information, which is usually so freely offered under similar conditions, is not available in this case.



A GOOD MACADAM ROAD.

EDITORIAL COMMENT

Asphalt Paving Specifications.

The Decision in the Peoria Electrolysis Case.

Road Surfaces to Suit the Traffic.

ASPHALT PAVING SPECIFICATIONS.

The doctors seem to disagree upon the standardizing of asphalt paving specifications quite as much as upon wooden block and concrete paving specifications. The specifications as adopted by the Organization for Standardizing Paving Specifications were given in MUNICIPAL ENGINEERING, vol. xxxviii, p. 234. On another page of this number will be found the objections of one chemist to some of the principles on which these specifications are based; also the report of F. P. Smith for the sub-committee on asphalt paving specifications of the American Society of Municipal Improvement, which, while following the former specification in some details, is materially different in others, and is built, in some respects, upon a different principle.

Mr. Perdue would reduce the specifications for the asphaltic constituents of the pavement to ductility, viscosity and penetration. But at the same time he compares the making of asphalt specifications to the making of cement specifications, wherein the major part of the requirements are purely physical and not chemical. He seems to forget that the cement industry went through the same periods of adherence to chemical requirements and naming of certain acceptable cements as standards of quality that asphalt is passing through, and that at the present time the chemical test is demanded by the most acceptable specifications for every cement whose origin and process of manufacture has not been proven to be correct by years of use. The cement industry has not yet entirely passed this period, but the chemists have reduced the probable sources of materials for making cement to such definite substances that, for the ordinary engineer who is simply insuring the receipt of material up to an acceptable standard, the question of chemical composition seldom arises. If he has a perfectly safe specification, however, it has the chemical requirements for use when circumstances demand.

Asphaltic materials have so many different sources that it has not been so easy for the chemists to eliminate themselves entirely and reduce the tests of asphalt safely to the physical tests alone. In the writer's early experience but one kind of asphalt was specified for pavements, partly because no one outside the companies promoting its use, and probably no one inside, knew enough about either chemical or physical tests to feel safe in including asphalts from other sources, or to feel sure they knew how to manipulate other materials of different constitution in making paving mixtures. One of his earliest tasks in taking the duties of city engineer was to find an asphalt which could be used in competition with the standard. Chemical theories were so crude that they had to be thoroughly tested by experience before they could be confidently accepted. The new material was acceptable, and has been one of the standards ever since. This led the way for other materials, good, bad and indifferent, which have met with varying degrees of success, according to their qualities and the expertness with which they were handled. Every conceivable method of testing was tried before the present methods were developed. And the chemists generally do not yet feel safe in cutting so completely loose from the chemical tests as our Kansas City correspondent would have them, though they are approaching each year nearer to physical tests as the practical standards of

quality after the particular brand or mixture of brands of asphalt to be used in the particular pavement has been decided upon.

There is equal difference of opinion regarding the binder course, most pavement builders, however, finding some such method of connecting foundation and wearing surface necessary for the best results.

Neither the standard specification nor that of Mr. Smith states the purpose of the mixture of sizes of aggregate in wearing surface to be the inherent stability of the mineral aggregate. The standard in particular follows rather closely the old empirical formula, while Mr. Smith gives an opportunity, through his allowable variations in percentages of sizes to produce the highest possible stability, or the lowest percentage of voids. That the latter method of procedure produces excellent results with larger sizes of maximum sized particles has been proved by Mr. Warren. That it should be valid for an asphalt pavement wearing surface, as Mr. Perdue maintains, seems reasonable. Mr. Perdue, however, states that the voids may be reduced to 25 per cent., but in the same paragraph prescribes 10 to 10.5 as the percentage of asphaltic cement to be used, which apparently does not fill the voids.

These details are still subjects of discussion and others of our readers may be willing to express themselves regarding them.

Mr. Smith has attempted to arrange the specifications in a more logical order than they are in the standard set, and differs in some details besides those mentioned above. It is to be hoped that the committees of the two organizations, which have several common members, will be able to agree upon a form which will embody the good features of both these sets of specifications. It would be unfortunate if two sets of specifications should be presented by two bodies of municipal engineers as standards. The confusion would be increased rather than diminished. It is hardly probable, however the duplication of membership in the two societies being so great, that they would put themselves in the position of the major in charge of the army post, who carried on an official controversy with himself as post quartermaster over the furnishing of certain supplies.

THE DECISION IN THE PEORIA ELECTROLYSIS CASE.

The suit of the Peoria Water Works Company against the Peoria Railway Company to stop injury to its pipes by electrolysis by stray currents from the street railway lines, has reached the stage of a preliminary decision. A report in MUNICIPAL ENGINEERING for 1901 of the recommendation of the Master of Chancery deputized to take evidence states his opinion that the street railway company should be required to install a double trolley system. This report was not acted upon until 1908, when it was again referred to the same Master of Chancery for further investigation. He made a second report in 1909 in which he reached the same conclusion as in the first. This report is now taken up by the judge, A. L. Sanborn, of the U. S. Circuit Court for the Northern District of Illinois, and he has made a decision in the case which differs materially from the recommendation of the Master in Chancery.

In the ten or twelve years since the case was first put under investigation, there has been great advance in our knowledge of the facts of electrolysis, and it is now possible, through co-operation of the corporations interested, to reduce the danger of damage to a minimum.

The court recognizes these facts; and, while deciding that the street railway company should be enjoined from continuing its injury to the water mains, it makes the condition that the water company co-operate with the street railway company and that reasonable time be given for making the improvements. Costs of the proceedings are divided between the two parties.

It seems to have been shown by the evidence that the area in which dam-

age occurs is not large and is located in the vicinity of the power house, and that the most economical and satisfactory results have been obtained by co-operation of the two systems interested. Who shall pay the expenses of the work is not yet decided, but apparently it is the street railway company. Details will be worked out when a decree is applied for in compliance with the general conclusions of the judge's decision as to the general principles involved.

The first difficulties of this nature were between the telephone and street railway companies. In these cases the street railways were first in the field, and it was possible by proper construction for the telephone companies to protect themselves at a cost, particularly for new construction, far below that necessary in revising street railway construction to prevent interference.

In the present case the water company was first in the field, and the same is doubtless true of many other cases in water, gas, conduit and other underground lines. But, now that all these various uses of the underground space under city streets are established, and it is a matter of chance as to which comes in first; and it is possible to protect largely against damage from construction by future companies at low expense, if the first design and construction are properly made, the courts are coming to recognize equality of rights of all these companies without reference to priority in any particular city. So, while the greater part of the burden may be laid upon the later arrival, as in the Peoria case, the duties of the other company are recognized.

In one sense the decision is a victory for the street railway company, since the whole burden and cost is not laid upon it, as was thought possible and perhaps equitable when the suit was first started, and the water company is instructed to co-operate in the work of improvement. It may also be considered a defeat for the water company to this extent, because it could very properly claim that it could not be expected to foresee the effect of the construction of a street railway system which was not invented or was in its infancy when the water company's pipes were laid. But the street railway has most of the work to do and will probably be required to pay nearly if not quite all the expense, so that on the water company will fall only the burden of helping in the task of keeping the relations of the two systems in safe condition.

The opinion of Judge Sanborn is eminently sane and practical, and should serve to clear up the numerous similar problems that have been waiting for this decision.

ROAD SURFACES TO SUIT THE TRAFFIC.

The course of road and street construction is shown by articles in this number of MUUNICIPAL ENGINEERING from the top-soil roads of Georgia to the latest improved sheet asphalt pavement for city streets. There are many forms of road and street surfaces all the way between and beyond, perhaps in both directions. It is the duty of the engineer and road official to select that which will be of most value for the particular conditions of each case.

The top-soil road described in one article is apparently well suited to the infrequent travel on the roads in the Georgia county in which they have been developed, and to the low value of the lands and low tax rates and bonding abilities available. They lift the farmer out of the mud and enable him to haul larger loads along the roads. Apparently the result of the treatment given the roads is a rather low quality of gravel road, sufficiently impervious to shed water falling or draining upon it, and thus conserving the bearing power of the natural soil. Evidently the road must be well drained or the sub-soil must be as impervious to the absorption of water as is the improved surface. The better roads thus obtained will aid in the improvement of conditions, increase the value of land and consequently the taxing and bonding ability. So,

when the top-soil road is outgrown it will have produced the value necessary to pay for its replacement by something better. This is true economy.

Continuous repairs will prolong the period of efficiency of such roads and add to their economy, at the same time that comparison of the cost of this repair with that of better roads will ultimately aid in the demonstration of economy of replacing the top-soil roads with better roads when the time comes for further improvement.

The unbiassed observer will perhaps not enter fully into the enthusiasm of the author of the paper, who is the developer of the road, but will rather be disposed to warn other road officials to study thoroughly the economy of the construction and the adaptability of the available materials before adopting it for any of their own roads.

On a somewhat higher plane the Indiana gravel roads have been constructed at a cost some three or four times as great, and they have very largely aided in the widespread advance in the profits of agriculture and consequent general advance in value of farm lands. In that state the advancement has reached the period when still better main roads are demanded, and now strong efforts are being made to establish a state road system under an expert highway commission which can confidently be expected to build the best roads which the demands of traffic and economy of construction and maintenance demand.

The construction of these comparatively cheap gravel roads has been fully justified by the results; and now that the time for better roads has come, the main roads can be replaced by the modern types of wearing surfaces without throwing away valuable road material, while the less traveled roads can be kept up to the demands of the traffic on them by a constant and consistent system of road repair under the expert guidance of the commission.

What these new roads shall be built of, whether tar or asphalt macadam, bitu-mass, bitu-mineral, bitulithic, asphalt, brick, concrete, or even wood, must be determined by the expert commission after a careful study of the conditions for each road, if the best and most economical results are to be attained. All failures of road construction are due to four causes, which really reduce to one; they are poor material and workmanship in construction, neglect of maintenance, excessive cost of construction or maintenance, all of them really dependent upon the choice of the proper method of construction and maintenance to fit the particular road. It is not surprising that there are so many failures in road building, for the roads are so seldom planned by experts. Some even of the state roads have been failures because those in charge of them were not so expert as they were supposed to be. The activity in promoting new materials and methods for road construction has been very great in the past five or ten years and some real experts have developed, and the number of competent road engineers is increasing with some approach to the rate of increase in the demand for them.

If the fitting of the character of the road to the demands upon it is fully considered in design and construction, we will have economical roads as well as better roads, and the good work will be popular. If fixed standards are imposed without reference to local conditions, expense of construction and maintenance will be in excess of benefits, and a reaction will set in. During the present dearth of competent road designers and constructors the economic results desired can be expected only if the work is under the direction of a central state commission with power to enforce its decisions upon the technical and economic problems involved.

THE QUESTION DEPARTMENT

Life of Wooden Water Pipe and Spacing of Bands.

I beg you to give me some information regarding the use of machine banded wooden pipe for a gravity drinking water system.

The diameter will be six inches, and the length of the pipe will be 14,600 feet, and divided as follows:

8,150 feet to withstand a head of 50 feet.

5,150 feet to withstand a head of 75 feet.

1,300 feet to withstand a head of 100 feet.

What I would like to know is, how the life of wooden pipe compares with steel riveted in the local soil, which contains a certain amount of alkali.

What formula is generally used to determine the diameter of the spacing between the wire? E. P., Maxwell, N. M.

A summary of a discussion by the American Society of Civil Engineers and a collection of data from other sources are given in MUNICIPAL ENGINEERING, vol. xxxvi, p. 239, and a little additional information is on p. 243. The points of particular interest in connection with the above questions are that the staves must be kept wet, and that a gravity line should have a head of about 50 feet to insure this; that filling round the pipe should be free from organic matter or growing tree or other vegetation roots; that the head should not be more than 150 to 200 feet. Clay and loam which are free from vegetable matter are recommended for use as filling around pipe. No information is given as to the action of alkaline soils, but it is recommended that the effect of the local soil on wooden pipe be carefully studied, also its effect on steel pipe or cast-iron pipe. References to previous articles are also given. There is a brief general article, illustrated, on wooden pipe conduits in vol. xxxix, p. 13.

The formulae for determining size and spacing of bands are given in Turneaure and Russell's "Public Water Supplies" ($5), also a table giving dimensions of staves, bands, etc., for pipe more than 10 inches in diameter. To determine the size of band, the safe strength of the band is taken as equal to the safe pressure per lineal inch of band multiplied by the radius of the exterior of the pipe. The safe pressure per lineal inch of band, using a factor of safety of 4, depends on the crushing strength of the wood and the area of the contact of the band with the wood, which is assumed from observation to be equal to the radius of the band for safe compression of the wood by the band, and is assumed as 650 times the radius of the band. This equation gives the radius of the band as equal to the stress on the band divided by 650 times the radius of the exterior of the pipe.

The spacing of the bands is derived from a similar equation and equals the total safe stress on the band used in the previous equation, divided by the water pressure plus the swelling force of the wood when wet. The water pressure is equal to the pressure per square inch due to the head, mutiplied by the internal radius of the pipe. The swelling force of the wood is equal to 100 times the thickness of the staves. All dimensions are in inches and pounds.

The two equations must be used together and the computations modified until reasonable results are obtained for both.

The table gives for a pipe 10 inches in diameter the stock sizes for staves as 1½ by 4 inches, the thickness of finished staves as 1 1-16 inches, the economic sizes of bands as 5-16 by 7-16 inch oval crosssection, the safe working stress in band as 1,255 pounds and the consequent factor of safety of 5.26. This leaves only the spacing to be determined by the latter formula given above for the maximum head at the point for which the computations are made.

Information About Hydrant Rentals.

I want to get articles in MUNICIPAL ENGINEERING about hydrant rentals.

S. H. L., New York City.

The following articles in MUNICIPAL ENGINEERING will be of particular interest in connection with this subject:

In vol. xxxvi: A part of the article on "Water Rates" on p. 212.

In vol. xxxv: Hydrant rentals in a number of cities and a brief statement of the principles which should underlie their determination are given on p. 31. Another statement of these principles is given in an article on "Water Rates and Rentals" on p. 73.

In vol. xxx: Some hydrant rentals in the smaller cities are given on p. 306.

In vol. xxviii: A fair discussion of the basis for fixing hydrant rentals and the rentals charged in some seventy cities will be found in an article on p. 464 entitled "What Would Be a Fair Basis for Fixing Water Rates for Fire and Domestic Service."

In vol. xxvi: The question of deductions from hydrant rentals for lack of

pressure is considered, with references to court decisions, on p. 23.

In vol. xxiv: Perhaps the most practical discussion of the subject of hydrant rentals is that on p. 182 when supplemented by the article on p. 189.

In vol. xxiii: The location of hydrants and incidentally its effect on rentals is sketched in an article on "Hydrants, Meters and Wastes" on p. 185.

In vol. xxi: Two decisions on cases for collection of hydrant rental are given on pp. 94 and 95.

In vol. xv: A number of rates for fire hydrants are given on p. 235.

Cost of Cast Iron Pipe.

Would it be possible for you to ascertain for us quotations of cast-iron water pipe during the years 1904 and 1905?
I. C. S., Waverly, N. Y.

The New York quotations on cast-iron pipe per gross ton, given monthly, were as follows, the first figure, where two are given, being for 6 to 10-inch pipe and the latter for larger pipe: January to July, 1904, both inclusive, $28 and $27; August, $25.50 and $25; September to November, $25 to $25.50 and $24 to $25; December, $26 for 6 to 10-inch; January, 1905, $26.50; February and March, $26.50 to $27 for 6 to 10-inch; April, $26.50; May, $28 to $28.50; June, $28; July to September, $27; October to December, $27.50.

During the same period bids were received and contracts were let in various cities in New York and Pennsylvania at the following prices, presumably per net ton, the figure being either the contract price or the lowest bid in case contract was not reported let:

February, 1904: Auburn, N. Y., $22.60 for 12-inch pipe; Philadelphia, Pa., $30 per net ton for 3 to 48-inch pipe, although one bid was $24.40; Reading, Pa., $25.66. March, 1904: Newark Valley, N. Y., $23.50 for 4-inch, $23.40 for 6-inch and $23.25 for 8-inch pipe; Philadelphia, Pa., $33 for 16 and 24-inch, $33.50 for 20-inch pipe. April, 1904: Yonkers, N. Y., $24.40 per gross ton for 18-inch pipe. June, 1904: Hudson, N. Y., $22.35 for 6 to 18-inch pipe. September, 1904: Wallkill, N. Y., $22.50 for 4 and 6-inch and $22 for 8-inch pipe; New York city, $25 for high pressure pipe. October, 1904: New York city, high pressure, $26.50; for standard water pipe, $22.50. November, 1904: New York city, standard water pipe, $23.50 for one contract and $24.50 for another; Troy, N. Y., $22.85 for 6 and 12-inch pipe. January, 1905: New York city, standard pipe, $25; high pressure, $29. April, 1905: Oswego, N. Y., $26.70. July, 1905: New York city, $26.50. August, 1905: New York city, $24.95. September, 1905: New York city, $26.75 and $27.50. October, 1905: New York city, $27.50. November, 1905: New York city, standard, $27.50; high pressure, $38. December, 1905: New York city, $30, $29.30 and $29.50.

The monthly quotations are for delivery at tidewater, New York. The bids and contract prices are for delivery, usually f. o. b. cars, at the place named.

Steel Sheet Piling for Well of City Water Supply.

Our water works water supply is a large well 20 feet deep in coarse gravel. For a special reason it is desirable to sink a hole in the bottom, say 6 feet in diameter and 10 feet deep. Allow me to ask your opinion of setting up metal sheet piling in a circle of required diameter to drive and excavate inside of it. I conceive that this excavating may be done by sand pumping for the finer material and loading the coarser by hand with scoop and tongs under water the object being to keep the main well in service during the work, the well being pumped to its lowest limit continuously to permit the work. The piling being drawn, would it be feasible left in as permanent curb? The well is arch-covered with about a 2-foot manhole for entrance of materials and work. A drilling rig might be used to facilitate work. C. V., ———, Ohio.

The plan is certainly feasible if the details are properly handled. The piling can be kept as the permanent curb if protected from rust, or if a concrete or brick wall is built to take its work before it rusts enough to be in danger of giving way.

Will our readers report their experience in this use of sheet piling for the benefit of our correspondent and many other readers?

Efficiency of Gasoline and Alcohol Engine.

Will you kindly advise me whether an engine made for kerosene, gasoline, alcohol and other fuels is as efficient and satisfactory as an engine run by gasoline only? Which is the more reliable and least troublesome? W. L., Jeffersonville, N. Y.

The natures of the fuels used in internal combustion engines are so different that in general they require very different treatment to produce the most economical results. The dimensions of cylinders must even be changed for some of them. The fact that the same engines have been used for different fuels has given use to considerable misinformation regarding their relative economies. It does not seem possible, therefore, that an engine made for all fuels could be as economical as one designed particularly for the use of one of them. With but one or two exceptions these statements are applicable to the use of any of the fuels in an engine designed for any other one of them.

The reliability and freedom from trouble of any engine is a matter of design and care rather than of the fuel for which it is designed. The development of the automobile has given the gasoline engine a precedence in perfection of design which it is difficult for the others to meet.

Can our readers report details of their experiences in case they have had opportunities to compare the various fuels used in internal combustion engines?

Makers of Electric Rock Drills.

I am in the market for an electric rock drill for ordinary quarry work. Is there such a thing on the market that is a success? Our stone crusher is operated by electricity, and I want to save the first cost of buying an electrically operated air compressor to run the drill if it is possible to do so. We run but one drill.

D. F. M., St. Albans, Vt.

There are numerous makers of electric drills for all kinds of work, such as the Marvin Electric Drill Co., Binghamton, N. Y., Jeffrey Manufacturing Co., Columbus, O., the General Electric Co., Schenectady, N. Y., the Westinghouse Electric and Manufacturing Co., Pittsburg, Pa., which are applicable to quarry work. Will our readers add to this list, which is limited to those with which the writer is personally acquainted?

Eastern Installations of Septic Tanks and Contact Beds.

This town contemplates the installation of a sewage disposal plant, and, on account of limited space to erect the same, together with soil conditions, generally bordering on hardpan, I have thought best to study the septic tank and contact filter system. Will you be good enough to give a list of such plants in operation in the east, so that we can make a personal inspection of them in operation?

A., Town Engineer, ———, Conn.

The line of demarkation between septic tanks and settling tanks is not always sharply drawn. Many of the tanks in use are settling rather than septic tanks. The following list includes both: Andover, Brockton, Clinton, Gardner, Hopedale, Leicester, Marlboro, Southbridge, Westboro, Worcester, Mass.; Pawtucket, Woonsocket, R. I.; Waterbury, Conn.; Ballston Spa, Ithaca, Lancaster, Liberty, Mt. Vernon, Olean, Saratoga Springs, N. Y.; Plainfield, Rutherford, N. J.; Allentown, Altoona, Hanover, Washington, Pa. Of these, Hopedale, Mass., the New York and New Jersey plants may most of them be considered to be septic tanks. Contact filters are not numerous in this country. Ballston Spa and Lancaster, N. Y., Plainfield, N. J., Pawtucket, R. I., Allentown and Hanover, Pa., are eastern examples.

Prevention of Odor from Septic Tank Effluent.

In what manner can the effluent from a septic tank be filtered or disposed of so as to prevent bad odors. The effluent is retained somewhat too long, the septic tank being too large, and can be run into a body of water, not large enough to dilute the raw sewage, the purity of which does not matter. Prevention of odor is of first importance.

A. W. K., ———, Ill.

Some of the odor can be eliminated by reducing the dimensions of the septic tank. If it is too deep this can be done by filling with some compact material, leaving the proper volume, but not reducing the depth unduly. If it is too wide, a partition can be put in and the space behind the partition filled. If too long, the same can be done, preferably at the inlet end, leaving a channel for the incoming sewage to reach the tank. This filling can be taken out later when the increase in amount of sewage requires it.

The effluent from the tank can then be discharged into the body of water so that it will not be exposed to the outer air until it has been mixed with the clean water. If the body of water is a lake or pond, the effluent pipe should discharge its sewage some distance from the shore, and it may even be necessary to give two or more outlets, so as to distribute the odorous water somewhat. The odors will then be absorbed by the water of the pond and will produce little or no nuisance. If the water is in a stream, it may not be so easy to insure that the end of the effluent pipe will always be covered and the water at that point be kept moving, but this condition should be approached as nearly as convenient.

Size of House Connections to Sewers.

I have a discussion with a local plumber concerning the size of sewer pipe to use for house connections. I take the stand that nothing smaller than 6-inch should be used, but he says 4-inch is large enough. I would be very glad to know what is used in eastern towns.

J. W. B., ———, Okla.

For residences of almost any size even a 4-inch pipe is larger than is absolutely necessary to carry the house drainage. It is large enough to carry roof water also, provided the roofs are not of excessive area, and also provided it can be laid at the usual minimum gradient of 1 in 40. Assuming no storm or roof water in the house connection, it must be kept clean by the flushes from closets, the discharges from bathtubs and sinks, which are all intermittent, and some very brief. The gradient of 1 in 40 is sufficient to give a flushing velocity to the discharge, and the amount of the discharge is sufficient to fill a 4-inch pipe full enough to flush out any ordinary solid matter. If the pipe is 6 inches in diameter it is too large for most of the intermittent discharges to do their full duty in moving stranded solids, for the water will be shallow and its force will be diminished, even if its velocity is kept up. This is the explanation for the statement, said to be based on observation, that 6-inch pipes used in house connections have more stoppages than 4-inch pipes.

The course of reasoning followed above might be used to reduce the house connection to 2-inch diameter, but for the fact that many discharges contain solid matters which would jam in a 2-inch pipe and stop it up completely. The 4-inch pipe is therefore better than either the 2-inch or the 6-inch.

Similar reasoning applied to the street sewers in a separate system, and similar observation, lead to the adoption of 8-inch

pipe as the minimum size rather than 6-inch or 10-inch.

If storm water is admitted to the house connections, their size must be computed for the maximum flow of such storm water from roofs, areas, etc. But even here, the size must be kept down to the smallest possible to carry this maximum flow without back water or overflow, because in the intervals between storms the intermittent discharges from the house system must be depended upon to keep the pipes clean.

Municipalities Operating Garbage Reduction Plants.

Will you kindly send us a list of municipalities operating their own garbage disposal plants, those who reduce their garbage and make fertilizer, etc., not incinerating plants.

F. D. C., Cleveland, O.

The only cities in the above class known to the writer are Cleveland and Columbus, O.

The cities of more than 30,000 population which collect their own garbage and turn it over to a contractor for reduction are New York, Chicago, Boston mainly, Detroit, Cincinnati in part, Rochester largely, Toledo part reduced and part burned, Syracuse in part, Dayton, O., Wilmington, Del., in part, New Bedford, Mass., in part, Troy, N. Y.

The cities in which garbage is collected and reduced by contractors are Philadelphia, Baltimore, Pittsburg, San Francisco in part at present, but will change to municipal incineration soon, Washington, Newark, N. J., Indianapolis, Ind., Omaha, Neb., Paterson, N. J., Reading, Pa., Bridgeport, Conn., Utica, N. Y., Dubuque, Ia., York, Pa. Vincennes, Ind., is practically the only smaller city having a garbage reduction system. It is operated under contract.

Specifications for Sidewalks, Concrete Mixing, Inspectors' Reports.

1. What is considered the best practice in machine mixing, with batch mixer? Required, for instance, the necessary number of revolutions of drum per batch, after the last unit of material enters the machine, and before any portion of the concrete is discharged.

2. What would be reasonable output of good concrete from a 9-cubic-foot Smith mixer on sidewalk work, loading with barrows and dumping into barrows, 8-hour day.

3. What is considered good practice in sidewalks construction as to

a. Depth of walk (concrete).

b. Depth of wearing coat.

c. Size of sand grains or small gravel in finish coat.

d. Expansion joints (maximum range of temperature, 150 deg. F.)

e. Preparations for concrete and wearing coat.

4. In machine mixing are any dry turns required? That is, any revolutions of drum before water is applied?

5. In hand mixing, sidewalk and curb work, number of turns required dry and wet.

6. Is it good practice to use unscreened gravel in sidewalk work? Required size of aggregates in sidewalk and curb construction.

7. Have you any data on inspectors' reports for street paving, sidewalks, curbs, etc.?

8. Do you recommend compression tests on concrete to be used in sidewalks?

9. Do you know of any abrasive or rattler tests on concrete cubes, to determine wearing qualities of concretes of different materials or preparations? Would you recommend such tests?

You will see that my questions are presented in a rather disconnected form. The points I wish covered are of vital importance to this city.

J. N. E., ———, Mont.

1. The designs of batch mixers vary so much that no general rules for handling them can be given. Each mixer must be studied and experimented with until the best results are obtained, and the program producing these results should then be adopted. In general, the materials should be mixed until the mass attains a uniform color and appearance as to mixture of sizes. Opinions differ as to the order of procedure, and it must differ somewhat with the nature of the aggregates. The experiments with the mixture should cover this ground. Some mixers produce as good results with four or five turns as others do with twice as many. Uniformity in product is the requirement, and the order of insertion of materials and number of turns wet and dry must be such as to produce this result.

2. The maximum capacity of a 9-cubic-foot Smith mixer is said to be 20 cubic yards mixed per hour, which would be at the rate of one batch per minute. This supposes sufficient force to keep the machine filled promptly and instantaneous dumping. If the dumping is into barrows, which must be filled one at a time, there will be considerable delay, and the capacity of the plant may thereby be reduced to perhaps 9 or 10 cubic yards an hour. Idle time must also be allowed for, and the amount may easily be reduced to 6 or 7 cubic yards an hour. In other words, the management of the work and of the men is quite as important an item as the maximum capacity of the mixer. Perhaps our readers will give us some figures from their own work on this subject.

3. The standard specifications for cement sidewalks of the National Association of Cement Users have the following provisions:

a. Minimum thickness of pavement, 4 inches in residence districts, 5 inches in business districts; making thickness of base 3¾ inches minimum in residence districts and 4 inches in business districts.

b. Minimum thickness of wearing coat, ¾ inch in residence districts, 1 inch in business districts.

c. Fine aggregate is used in the top coat, consisting of sand, crushed stone or gravel screenings, graded from fine to coarse, passing, when dry, a screen having ¼-inch diameter holes, preferably of sili-

cious materials, clean, coarse, free from loam, vegetable or other deleterious matter, and not more than 3 per cent. shall pass a sieve of 100 meshes per linear inch.

d. The provision regarding expansion joints is that "in every 50 linear feet of walk, at least ½-inch expansion joint shall be provided. Any means which will provide this will be accepted." Joints entirely through the slab are also provided for. This question is considered at some length in the November number of MUNICIPAL ENGINEERING, vol. xxxix, p. 385.

e. For the base the proportions of materials should be such that the cement shall overfill the voids in the fine aggregate by at least 5 per cent. and the mortar shall overfill the voids in the coarse aggregate by at least 10 per cent. The proportions shall not exceed 1 part cement to 8 parts fine and coarse aggregates. When the voids are not determined the concrete shall be composed of 1 part cement, 3 parts fine aggregate and 5 parts coarse aggregate.

The proportions for wearing surface are 1 part cement and not more than 2 parts fine aggregate.

4. This is considered in paragraph 1. Five to fifteen turns may be required, according to design of mixer and character and condition of materials. There is much difference in practice as to time of application of water, and it is usually applied in the most convenient manner, preferably not all at once, but in such manner as to produce the most complete mixture and not wash the cement out of a mixture already partially made.

5. The standard specifications require that in hand mixing the ingredients of the concrete shall be thoroughly mixed dry, sufficient water added to obtain the desired consistency, and the mixing continued until the materials are uniformly distributed and the mass is uniform in color and homogeneous. The number of turns wet and dry will depend on the tools used and the manner of using them. Three times careful turning dry of the materials, as measured out, with a cement layer of uniform thickness on top, ought to be sufficient, and an equal number after the water has been added. If not enough, more should be required, and if the workmen are expert enough so that less will produce the result, the inspector may reduce the number of turns, with reservation of right to change when necessary.

6. A natural mixture of sand and gravel suitable for the base is sometimes found. If the inspector keeps watch of it and sees that it conforms in composition with the mixture above prescribed, there can be no objection to its use. The inspector should exercise great care in accepting such natural mixtures.

7. The "Forms for Daily Force and Material Reports," given in MUNICIPAL ENGINEERING, vol. xxxviii, p. 270, will give some valuable suggestions, though they are not directly applicable to the reports of inspectors. "Cost Keeping for Engineers," p. 340, and "Cost Keeping on Municipal Contract Work," vol. xxxvi, p. 1, are also valuable. A daily report form for street work will be found in vol. xxxiv, p. 239, intended for keeping track of city labor and teams, but may help in making the form desired in this case. A suggestive article on "Forms for Keeping Cost of Public Work" will be found in vol. xxxiii, p. 250. A list of previous articles on city engineer's office records, including field notes, is given in vol. xxxii, p. 18. The one applying most clearly in the present case is one on "Loose Leaf System for Field Notes and Office Records," in vol. xxx, p. 409, which gives forms for inspectors' note books on several kinds of work. They could be used with but little modification under any ordinary circumstances.

8. The writer sees no particular advantage or information to be gained from compression tests on samples of concrete for use in sidewalks. The quality of the concrete depends so much on the method of laying that a test on one block may not represent any other block on the work. Close inspection of the construction is of much more value than tests by compression.

9. The writer knows of no comprehensive rattler tests of concrete cubes. Such experiments as have been made have not given indications of value enough in the tests to induce experimenters to continue them. Again, workmanship is a governing condition. Undoubtedly hard materials in the aggregates will give more durable wearing surfaces for walks or roadways than soft materials, provided the other conditions are the same. It is quite common to require granite or other hard stone in the fine aggregate used for wearing surface of sidewalks where traffic is heavy. This is not necessary for walks on residence streets.

Street Improvements for Oregon City.

We are planning to improve our streets with about seventy-five blocks of hard surface paving this next season. Any special information concerning this feature of municipal improvements which it might come in your way to impart I will be pleased to receive.

L. L., Mayor, ———, Ore.

Reference may be made to the following articles in the current volume of MUNICIPAL ENGINEERING, which are directly applicable to the case of a small growing city:

"Brick Pavements in Rochester, N. Y.," p. 20; "Street Railway Track Construction in Brick Street," p. 30; "Filler for Brick Pavement," p. 31; "Sufficiency of Brick Specification," p. 32; "Cost of Brick Paving with Granite Curb," p. 33; "Remedy for Slippery Pavement," p. 33; "Cost of Asphalt and Bitulithic Pavements," p.

113; "A Little Bituminous Filler Story," p. 118; "Grooved Wooden Block Pavement on Steep Grade," p. 119; "Fond du Lac's Cement Streets," p. 136; "An Official Inspection of Brick Pavements," p. 138; "The International Good Roads Congress," p. 174; "Bituminous Roads, Mixed and Poured," p. 178; "Brick Highways in Ohio," p. 182; "Ordinance Requiring House Connections Before Paving Begins," p. 201; "Pavement Crowns," p. 212; "Action of Bituminous Expansion Joints," p. 212; "Expansion Joint in Concrete Pavements," p. 213; "Calcium Chloride for Dust-Laying and Road Maintaining Purposes," p. 214; "Street Paving in New Orleans," p. 260; "Wooden Block Pavement Tests in Minneapolis, Minn.," p. 265; "Work Preliminary to Road Construction and Street Pavement Maintenance," p. 270; "Brick Roads at the International Road Congress," p. 276; "The Concrete and Macadam Streets of Richmond, Ind.," p. 281; "Cement Streets of Fond du Lac, Wis.," p. 284; "Crown for Brick Street," p. 292; "Bituminous Filler Again," p. 294; "Concrete Pavement in Delphi, Ind.," p. 294; "Tar Macadam Test Road," p. 295; "An Expansion Joint Form," p. 296; "Cost of Maintaining Asphalt Streets in Brooklyn," p. 314; "Convict Labor on Roads," p. 315; "Sidewalk and Curb Grades," p. 354; "Bituminous Pavements, Patented and Otherwise," pp. 358 and 361; "Pavements of Erie, Pa.," p. 364; "Supervision of Municipal Work," p. 368; "The Economies of Modern Highway Engineering," p. 374; "Specifications for Expansion Joints in Cement Walks," p. 385; "Relative Action of Calcium Chloride and Oil on Stone and Gravel Roads," p. 392; "The Ohio Experiments on Road Binding Materials," p. 401. Also the articles in the current number. These articles cover practically the whole paving field and the same will be found to be true regarding any volume of MUNICIPAL ENGINEERING. Our correspondent, who is a new subscriber, is therefore recommended to watch the current numbers and to avail himself of the bound volumes as he finds it convenient.

Standard Forms of Books for City Offices.

Please advise me where I can procure the best kind of a record book for the use of the city clerk, also a complete set of books for the city water commissioner, including meter reading books, as well as the consumers' register and ledger. It would be well, if you have blank pages of any or all of the above books, to forward same to me, or advise me where I can procure them. I would like also to get hold of a good form of blank book for the recording of licenses issued.

S. C. H., ———, Neb.

The duties of city clerk differ so much in different states, and even in different cities in the same state, that no general form of book can be devised. The same is true, though to a less extent, regarding books for recording licenses.

Will our readers supply forms which they have found convenient? They will be published for the benefit of our correspondent and others interested.

As regards water works records, the American Water Works Standard Bookkeeping System, published by MUNICIPAL ENGINEERING COMPANY, Indianapolis, Ind., is complete and convenient. It was developed from the forms in use in several water works plants, and includes the best features of all of them. Circulars and sample sheets are sent on request. It covers all the accounts mentioned above.

The Public Accounting Departments of such states as Ohio and Indiana have forms of books for keeping municipal, county and township accounts, which can probably be secured upon application.

The article on "Bookkeeping for Metered Water System" in MUNICIPAL ENGINEERING, vol. xxxviii, p. 183, will be of much interest in this connection.

Vacuum Street Cleaning Machine.

In your issue of November, in the Question Department, you refer to vacuum street cleaning machines. I am very much interested in same, and would be glad to know where I can secure descriptive matter of the Furnas cleaner, which you say has long since demonstrated its success.

F. L. J., Chicago, Ill.

The new Furnas automobile cleaner is ready for demonstration, but no printed matter concerning it is yet available. McMeans & Tripp, 710 Majestic building, Indianapolis, Ind., are the mechanical engineers building the machine, and will respond to all inquiries.

Information About Franchises for Public Utility Corporations.

This city is in need of information pertaining to granting of franchises by the city to public utility corporations, such as telephone companies, gas companies, street railway companies, etc. Can you give us any information as to where a book or books treating upon these subjects can be purchased? We are in touch with the publication, "Municipal Franchises," by Delos F. Wilcox. Is there any better?

C. R. BEARDSLEY, City Engineer,
Corvallis, Ore.

The book referred to is the only general treatise on the subject.

The three volumes of the report of the National Civic Federation on "Municipal and Private Operation of Public Utilities" have much of value in this connection. They can probably be obtained at the office of the Federation, 281 Fourth avenue, New York City.

The annual reports of the Railroad Commission of Wisconsin, which has charge of most of the public service utilities of the state, are also mines of information.

MUNICIPAL ENGINEERING has a number of articles on the subject which are directly applicable to the present case. One of these is that entitled "Some Provisions in Modern Franchises for Public Service

Corporations," on another page of this number. The principles underlying public service franchises are discussed in an article in vol. xxxviii, p. 335. Another on "Principles Underlying a Street Lighting Contract" will be found in vol. xxxv, p. 96, and "A Modern Municipal Franchise" is described on p. 306.

In vol. xxxviii, pp. 317 and 340, are articles on percentage of receipts and other forms of compensation for street railway franchises which may be of interest in this connection. One on p. 335, on "Co-operative Franchises for Municipal Public Service Corporations," is of direct application. It refers to an article giving in full the terms of such a franchise proposed for a water company, which is printed in vovl. xxxvi, p. 247, and to a similar franchise proposed for a telephone company which has been printed in the proceedings of the American Society of Municipal Improvement and of the Indiana Engineering Society. Another article in vol. xxxviii, directly applicable to this case, is that on p. 393, "Factors That Should Be Considered in Making Street Lighting Contracts." Two on rates, on pp. 417 and 419, may also be consulted.

Fair Deal for Contractor.

Where the commissioners of a county have advertised for bids for the construction of bridges according to plans and specifications of an engineer appointed by said board of commissioners, has the said board of commissioners the right to reject a bid, though it be one-fourth less than the one granted the contract?

Is there any law governing the engineer in regard to making an estimate on work to be let by the commissioners of a county? For example, an engineer makes an estimate of $330 for a 4-foot arch 28 feet long, stating it contains 25 yards and concrete is worth $12 per yard, when it does not contain 25 yards and should cost not to exceed $6 per yard; another example: a 36-foot common I-beam bridge is estimated to have 18,000 pounds of steel at 5 cents per pound; all of which shows fraud on its face; all these facts show something wrong.

Where the whole set of commissioners, engineer and bridge company are working together in this way, and seem to have a perfect understanding, in what way can another contractor get a fair deal? I mean, bring them to terms.

E. C. W., Linton, Ind.

Publicity seems to be the only remedy for such conditions. Ultimately the State Board of Accounts should be given full power to enforce publication of all financial transactions in public offices in form readily understandable. When transactions are to be public in every sense, attempts at fraud will be discouraged. Pending the development of such legislation, the only course is to make public such transactions in some other way. A suit for injunction to prevent the letting of contracts in the manner described would be one way of procuring this publicity, care being taken to secure full reports of the progress of the case. Unfortunately, such suits do not always result in securing the injunctions. The court decisions attribute so much power to exercise their discretion to public officials that, unless fraud or violation of law is very definitely proved, judges are very apt to decide that the course of procedure followed by such public officials is within their rights and so cannot be interfered with. If such officials were certain that every doubtful transaction would be shown up, even by an unsuccessful suit, they would be careful at least to keep within the letter of the law.

Where to Obtain Street Scrapers.

Could you advise me where I could obtain a device drawn by horse to scrape mud from streets, I have seen such a device advertised, but cannot remember where. My recollection is that it is similar to a horse-power hay rake, with a hoe at the end of each steel spring, which scrapes depressions as well as level surfaces. It impressed me favorably when I saw it.

S. W. H., City Engineer, ———, Conn.

Names of makers of street scrapers which can be used for the purpose named will be found in the "Business Directory" published in each number of MUNICIPAL ENGINEERING, under the headings, "Contractors' Tools and Machinery," "Graders," "Plows," "Road Machinery," "Road Plows," "Scrapers," "Scraper Blades," "Street Contractors' Supplies," "Street Scrapers."

Where Can Oil Fulfilling Standard Wood Block Paving Specifications Be Obtained.

The sub-committee of the American Society of Municipal Improvement on wood block paving specifications recommended a preservative oil of at least 1.10 gravity at a temperature of 38 deg. C., and that the distillate shall not exceed 2 per cent. up to 150 deg. C. and 35 per cent. up to 315 deg. C. In fact, the specification covering the oil is fully as severe as the tentative specifications adopted at Chicago by the Organization for Standardizing Paving Specifications.

I ascertained the names of the members of the committee and wrote them a letter, calling their attention to the above specification, and concluding: "You further state that investigation on your part has shown that this oil is not controlled by one company, and I assume by this statement that you also assert that this oil is not controlled by allied interests of one company. You also state that it is easily obtained by any one, not only in this country, but abroad and in Canada. In view of the fact that I have canvassed this country, as well as foreign countries, for a delivery of 100,000 gallons of this oil, and found that it cannot be obtained, I must have omitted in my request the manufacturers whom you state can furnish this oil. Will you, therefore, kindly forward me the names of parties in this country, foreign countries and Canada who are manufacturers of this oil, and who have the capacity to furnish it in large quantities, from 50,000 to 200,000 gallons, in a reasonable length of time after the order is placed?"

Up to the present time I have not received a reply from any of the gentlemen on this committee; therefore, I believe it

is safe to assume that they did not know where the oil to the specification recommended by them could be obtained, as without doubt, members of any committee of a technical body, recommending a certain oil and stating positively that it could be obtained, would have been glad to give the information requested by a manufacturer, especially when a stamped envelope was inclosed for reply.

M., New York.

The sub-committee report referred to in the above communication was prepared by a single member of the committee after arrival at the convention, and was presented as such, and, in common with the other reports of sub-committees on paving specifications, was referred for further consideration to the general committee on standard specifications, and was not adopted by the society. There was some confusion as to the membership of committees which was not cleared up, so that the failures to reply to our correspondent's letters may have been due to the lack of information on both these points on the part of those to whom the letters were addressed.

The duties of the committee on standard specifications and its relations to the work of its sub-committees were more definitely outlined after the confusion attending the presentation of their reports, and their work will undoubtedly be better co-ordinated in the future.

Our correspondent's letter is published practically as received, because the writer had a similar difficulty in ascertaining sources for obtaining the oil specified by the Chicago convention, by private inquiry, and therefore presents the letter with request that our readers send us such information as they can give, that the matter may be cleared up. Our correspondent's name is not given, but he is a manufacturer who uses quantities of oil such as he mentions. Replies will be forwarded to him as received.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Asphalt, Asphaltic Macadam and Bitulithic Pavements.

To the Editor of MUNICIPAL ENGINEERING:

Sir—We notice on page 344 of your November issue what you say regarding the discussion of bitulithic pavements at the Erie convention of the A. S. M. I., printed on pp. 358 to 363. In the main this is excellent, but there are two points upon which I feel sure that I could convince you that your impressions are erroneous.

First—That the pavements referred to by Mr. Kingsley are very far from "strict adherence to the principles on which the bitulithic pavement rests." In fact, they are all entirely dissimilar from the bitulithic pavement. Your sentence from which the above is quoted indicates not only that the differentiation is very narrow, but that I so conceded it, when, as a matter of fact, the difference is very broad. For instance, all of the so-called bituminous concrete laid in Denver, to which Mr. Kingsley refers, was merely a bank gravel mixed with asphalt *as a foundation*, with a 2-inch wearing surface of standard asphalt sand mixture.

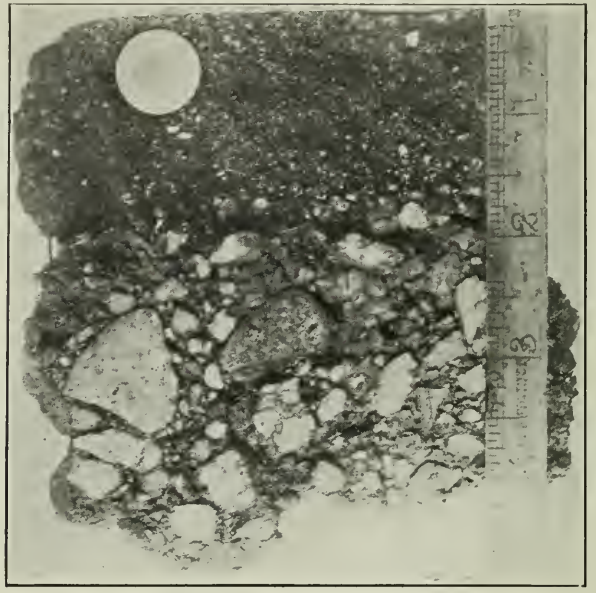
An examination of the samples Mr. Kingsley presented at Erie, as you state, bears out our contention that the surface is sand mixture originally laid 2 inches thick, and the foundation a mixture of gravel and asphalt. There are a few spots in Denver where the sand mixture is entirely worn off and the gravel mixture now exposed, but there is evidence that the pavements, when laid, had a 2-inch sand surface, and that Denver never laid any work with mixture of crushed stone or gravel in the wearing surface I regret that we cannot spare from our files samples showing this, but I am having made and will send you in a day or two a photograph of a cross-section sample further proving this fact.

Regarding Pittsburg, I am sending you small samples of the Lang avenue, Pittsburg, pavements, and the so-called asphaltic concrete pavement laid at Wellington, Kan. Examination of these pavements will clearly show you that they are substantially asphalt pavements with a very little fine crushed stone, substantially a standard asphalt pavement with no similarity to bitulithic, and absolutely mis-named "Asphaltic Concrete."

Second. You state, referring to discussion with Mr. Fred Warren, that you "are disposed to think that Mr. Warren did conceive the idea of the bitulithic pavement on account of his experience

with the Denver pavements." I am very certain that you are mistaken in this, and that in all the talks that I had with him during the preliminary development he never referred to the Denver pavements. Of course, it is possible that in a general way the weakness of the Denver work had some effect on his thought just as the weaknesses of asphalt pavements and the weaknesses of the tar macadam pavement, as laid in Hamilton, doubtless had an effect on his mind, and that the final thought which developed in the patent of a bitulithic pavement was the outgrowth of his experience and observation of all pavements.

GEO. C. WARREN,
Pres. Warren Brothers Co.,
Boston, Mass.



SAMPLE OF DENVER ASPHALTIC PAVEMENT.

1. Mr. Warren will readily be pardoned by our readers for desiring a full understanding of the conditions of the pavements for which claims of anticipation of the bitulithic patents have been made, and for wishing the editorial comments, to which he refers, to be as clear as possible. His statement may be taken as an amplification of the editorial statement referred to, for the writer can see no essential difference between the two. Practically all the samples shown approached the appearance of that shown in the accompanying photograph. One Denver sample, referred to in the aforesaid editorial comment, had the general appearance of having been a mixture of the materials used in both bottom and top, for the larger stones were scattered all through it. They were not numerous nor large enough, nor were the voids small enough to meet the patent requirement of inherent stability of the aggregate, and it is quite possible that the top surface had been worn off. However, there was more fine material than shown in the foundation in the photograph, and there were few stones of the size of the larger ones shown. One swallow does not make a summer, and one sample out of many taken to defend an infringement suit only emphasizes the departure of the others from the specifications of the patent, as well as showing its own lack of compliance therewith. The sample referred to approximated closely the general appearance of the samples from the Kansas and Iowa cities which very evidently are "lacking in strict adherence to the principles upon which the Bitulithic patents rest," though similar in appearance to the inexperienced eye.

2. Mr. Warren is to be commended for defending his brother's originality, in which the writer fully concurs, as shown in the editorial comment referred to. Mr. Warren's Denver experience helped lead him to the bitulithic pavement idea, not because he copied anything he saw there, but because he saw the defects of the Denver mixtures as he saw those of the pavements then called tar macadam. In the search for a cure for these defects he developed the mixture of sizes to produce an aggregate with inherent stability and the other attributes of his pavement. This

was the writer's understanding of his discussions of the matter with Mr. Fred Warren, and this is a little more definite statement of the fact given in the aforesaid editorial comment.

Cement Concrete Vats and Tanks.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Impervious, odorless, tasteless and sanitary vats and tanks for buttermilk, wine, oil, pickles, sauerkraut, etc., can be constructed of reinforced concrete, the reinforcing to be designed by a competent engineer, provided the interior surfaces are treated as follows:

After the forms are removed, grind off with a carborundum stone any projections due to the concrete seeping through the joints between the boards. Keep the surface damp for two weeks from the placing of the concrete. Wash the surface thoroughly and allow to dry. Mix up a solution of 1 part water glass (sodium silicate), 40 deg. Baume, with 4 to 6 parts water, total 5 to 7 parts, according to the density of the concrete surface treated. The denser the surface the weaker should be the solution.

Apply the water glass solution with a brush. After four hours, and within twenty-four hours, wash off the surface with clear water. Again allow the surface to dry. When dry, apply another coat of the water glass solution. After four hours, and within twenty-four hours, again wash off the surface with clear water and allow to dry. Repeat this process for three or four coats, which should be sufficient to close up all the pores.

The water glass (sodium silicate) which has penetrated the pores has come in contact with the alkalies in the cement and concrete and formed into an insoluble hard material, causing the surface to become very hard to a depth of ⅛ to ½ inch, according to the density of the concrete. The excess sodium silicate which has remained on the surface, not having come in contact with the alkalies, is soluble, therefore easily washed off with water. The reason for washing off the surface between each coat and allowing the surface to dry, is to obtain a more thorough penetration of the sodium silicate.

It is obvious that concrete surfaces so treated, if hard, impervious and insoluble, have been made impervious, tasteless, odorless and sanitary.

ALBERT MOYER, Assoc. Am. Soc. C. E.,
New York City.

Effect of Ground Water on Concrete Piles.

A test of the effect of ground water on concrete piles from which the casing used in driving the piles was withdrawn before the cement had set is afforded by the work on the new sewerage system of Louisville, Ky. The report of the engineers, J. B. F. Breed, chief, and Harrison P. Eddy, of Boston, consulting engineer, treats of the matter in connection with the building of an outlet structure down the bank of the Ohio river.

The contractor had already made an arrangememnt with the National Concrete Construction Company for the driving of reinforced simplex piles designed for the foundation of the drop chamber, and this arrangement was continued by the sewerage commission. These piles are about 20 feet in length and were driven through strata of sand, gravel and clay. The lower and last piles driven apparently met a very hard substance, which was supposed to be broken or partly disintegrated slate. The casing for these piles was 16 inches outside diameter and was driven with cast iron points. After reaching the required depth and approved penetration, the reinforcement and concrete were put in place and the casings withdrawn. A current of ground water passing by the piles had been thought to injure them by the washing away of the cement of the concrete. The current of the water as it appeared on the surface in the lower part of the trench was colored by the cement, immediately following the disturbance of the solid around the concrete by the withdrawal of the casing. Chemical analysis of the water also showed the presence of cement, within a very few moments after drawing the casing. Examination of three of the completed piles after they had attained hard set, indicated that they had been but very little affected by the ground water, and as the size of the simplex pile was much larger than the size required in the design of the sewer, their use appeared to be satisfactory.

Exclusive Rights of Water Franchise.

The borough of Brushton, Pa., by an ordinance passed in 1891, authorized the Pennsylvania Water Company to construct and operate a water works within the borough limits, and granted the said corporation the use of the streets of the borough for that purpose. The water works company complied with the terms of the franchise granted and proceeded to construct its plant and lay its mains. The grant for the right to use the streets of the borough was without a time limit.

In 1894 the city of Pittsburg annexed the borough of Brushton, assuming all contracts and obligations existing and valid between the borough of Brushton and other persons, firms or corporations.

In May, 1908, the city of Pittsburg claimed the right to extend its own water works system into the annexed borough, then the Thirty-seventh ward of the city. Thereupon the Pennsylvania Water Company filed a bill to restrain the city from proceeding farther. An injunction was granted, which, on hearing, was made perpetual.

It was held that where a borough grants a franchise to a water company and contracts for a supply of water, it cannot undertake to supply the water itself.

MUNICIPAL ACTIVITIES

Chicago City Hall—Austin Abattoir—McKinley Bridge—Oklahoma City Water Supply—Auto Fire Engine—Motor Fire Apparatus

Quality of Construction in Chicago City Hall.

Acting under the direction of the bureau of public officials, and as a result of a complaint from a bricklayer on the work, a board of experts was employed to investigate the construction of the Chicago city hall. This committee consisted of Mr. James Hollis Wells, of New York City; Prof. A. N. Talbot, of the University of Illinois, and Mr. A. J. Hammond, engineer for the bureau of publicity.

The report of Mr. Hammond summarizes the results of this investigation. An abstract of this reports is as follows:

I have found as a result of this investigation that some of the charges made by Mr. Coulson, particularly those pertaining to the concreting of the steel columns around the light courts and the spandrel filling of floor beams on some floors were substantiated, and also that some of the other exterior columns and spandrel beams were not properly protected with concrete.

I have also found that he was in error concerning the lack of brick backing in the granite columns and the lack of concreting around the steel columns inside of these granite columns, at least of the three examined, as these conform to the contract. The capital of the granite column in the county building, which was said by Coulson to have been hollow, when opened was found concreted, and the mortar, which was said to have been poor, was found to be of good quality.

Other charges made as to inferior floor tile, lack of concreting over the windows, and the straw lining in the party wall of the county building, were not substantiated.

Of the charges made, the most serious were the ones concerning the lack of concrete covering of the steel columns and beams, as this covering is of importance, not only from the standpoint of fire-proofing, but to protect the steel from corrosion. The practice of protecting steel by applying concrete directly to the structural steel was recommended three years ago by the National Board of Fire Underwriters, was called for in the city hall specifications, and should have been carefully done.

The further investigation has disclosed that the steel column at the northwest corner of the building was not properly concreted on the sixth floor, but on the seventh floor was well concreted. Also, at the southwest corner of the building the lower flange of one of the spandrel beams was exposed. While the entire structural steel was not examined, there were not enough instances noted where concrete was omitted to justify further cutting. It is also the fact that where openings were made the metal was found to be painted.

The book tile of the saw-tooth skylights had been whitewashed in place of being plastered, and the structural steel of the saw-tooth skylights had not been fire-proofed. The contractor has started this work. The plastering in general was of good quality and workmanship and conformed to the specifications.

Some of the Botticini marble used, particularly on the vault floor, was found defective. Quite a number of chipped and broken pieces of ashlar and capping in wainscoting and piers were found, which had not been condemned. This condition prevailed to some extent on the second and third floors. These defects were marked for condemnation by the architects at the time of our inspection.

Some of the Italian marble wainscoting and counter in the water-pipe extension room on the fourth floor, and the election commissioners' room on the third floor, were badly matched, and not equal to the sample submitted, but were found to have been already marked "condemned" by the architects.

The cabinet work on some floors was found to show a number of defects, some due to manufacture, others due to carelessness in packing and shipping, but the architects stated that the defective trim had been condemned. The mahogany jambs of the corridor doors had been tightly set up, and as the building was damp, some of the jambs had swelled and warped. This condition was due to the lack of being able to get heat into the building at the proper time, on account of the steam piping being concreted, a matter clearly due to carelessness, as all the fine cabinet work in the building was being subjected to extreme conditions.

The defects have, fortunately, not been very extensive and indicate to some degree careless workmanship, but more particularly they point to the lack of careful and efficient inspection and supervision. The inspectors state that they did not know that the steel columns were not concreted, nor that the steam pipes were concreted in solidly at the floor levels, or that rubbish was left here and there on floor arches, but ample provision had been made by the city for unusually careful inspection, and the character demanded the best talent available. This remark refers especially to the men who were employed to remain constantly on the work. The general superintendents and engineers are high-class men, but they had not given sufficient time to check their personal representatives on the work.

In general, this investigation has shown that some of the charges made were true, but more have not been substantiated. Other defects have been discovered, and in numerous places material was found which had been already condemned. Most of the defects can be easily remedied, and these have already been made good in many cases by the contractors.

It must be recognized as a pertinent fact, in such a large structure as the new city hall, that some work may be slighted by careless workmen, and will have to be corrected, that inferior stock and materials will be furnished, and these must be condemned, and the specific instances which have been pointed out are comparatively small when the building is taken as a whole, and indicate the ordinary skimping which frequently occurs in

contract work. There is no evidence so far as disclosed of any general and determined effort to skin the job.

Austin Contemplates a Municipal Abattoir.

A $10,000 municipal abattoir, after the plan of the one now in operation at Paris, Tex., is in the minds of the city administration of Austin, Tex. The need of a place where the meat used by the residents of Austin could be slaughtered under sanitary conditions is being strongly urged, as local conditions are said to be unsatisfactory. With this plant the city would control the fattening pens as well as the slaughter pens, and would keep them outside of the city limits or away from the residential part of the city.

The plant of Paris, Tex., is the one the city would adopt, as it is being taken up over the country. The plant would not make money; it is not the ambition of the city to make money, but it would be self-sustaining. At a charge of $1,25 for every beef and 75 cents for every sheep, hog, calf or goat, the city would be slaughtering the animals, rendering the tallow and producing "tankage" cheaper than any of the local butchers could do the same thing. The refrigerating plant would charge 10 cents per day for every animal left there longer than five days. The tallow would be sold to the laundry men and soapmakers at 5½ cents per pound, while "tankage," the residue, would be sold as a fertilizer for $23.50 per ton or mixed with grain and sold as chicken feed.

The Paris plant was described in MUNICIPAL ENGINEERING, vol. xxxix, p. 90.

The McKinley Bridge.

The formal opening of the McKinley bridge, across the Mississippi river, at St. Louis, occurred November 10. The completion of this bridge marked an important point in the development of interurban railroads west of the Mississippi.

The Illinois traction system came into the control of Congressman McKinley in 1900, being at that time but six miles in length, connecting Danville with Westville. It now operates over 500 miles of railway, connecting Danville, Urbana, Champaign, Decatur, Clinton, Bloomington, Peoria, Lincoln, Springfield and St. Louis. The lines in the north now extend from Princeton through Peru, Ladd, Marseilles, Spring Valley, La Salle, Streator, Ottawa and Morris. The twenty miles between Morris and Joilet will be completed soon, and from there it is planned to build the line into Chicago. A contemplated connection from Streator to some point on the Illinois traction system will give a through line from Chicago to St. Louis, and a western line will no doubt be built in the near future.

This system is not an interurban in the general sense of the term, but an electrically operated railroad, doing all classes of freight and passenger business, even operating sleeping cars.

The McKinley electric bridge was begun in November, 1907. It cost $4,500,000, is the largest bridge ever constructed to carry an electrically operated railway line, having a greater carrying capacity per lineal foot than any other bridge crossing the Mississippi. The steel structure includes three immense spans across the river, 521, 523 and 521 feet, respectively. In addition, there are two river spans of 250 feet each and three shore spans of 150 feet each. Steel elevated approaches form the connecting links at each end.

The approach on the Missouri end passes over twenty-four acres of freight yard owned by the Illinois Traction Company. The total length of bridge and approaches is over 8,000 feet. The main bridge carries two railroad tracks, while two roadways 14 feet wide are carried outside on cantilever brackets. The design of the bridge was prepared by Ralph Modjeski and F. E. Washburn was the resident engineer.

Test of Auto Fire Engine in New Bedford, Massachusetts.

The new Webb auto engine was officially accepted by the city council committee on fire department following a test, during which the machine pumped 800 gallons per minute—100 in excess of the contract stipulation. The test took place in front of engine house 10, in the presence of Chief E. F. Dahill, Aldermen Kerwin and Glennon and Councilmen McCarty and Charles W. Jones. The engine made a rapid run up to engine house 10 on Purchase street, and was connected with two 100-foot lines of hose, with which the pressure at the engine was kept at 120 pounds during the entire test. Two 200-foot lines were then tried and the pressure was kept up with these also.

Comparative Cost of Motor Fire Apparatus.

The fire chief of St. Louis gives figures on cost of maintaining auto fire engine as against horses on the first two months. The first cost of equipment is $600 greater for the auto than horse-drawn vehicle. The total cost of the auto for the first two months, with 117 runs, is $24.22 for gasoline and oil, and no other expenses. The cost of the horse-drawn apparatus corresponding would total $163.22, which is over six times as much.

Oklahoma City's Water Supply.

Oklahoma City, Okla., has grown by such leaps and bounds that the present water system is thoroughly inadequate to meet the present or prospective future demands of the city. Designed several years ago for a maximum capacity of 3,000,000 gallons, the growth of the city has been so abnormal that the present water consumption is between 7,000,000

and 8,000,000 gallons, and the present source of supply has been taxed to its utmost. Besides this, the character of the water from the present source of supply is thoroughly unsuited for domestic and manufacturing purposes. Mr. Alexander Potter, of New York City, has been retained to investigate the entire question of a suitable supply for Oklahoma City, which has a population of about 65,000, and his commission includes the investigation of such sources as will be suited for the city when it reaches a population of 200,000.

Many suggestions have been offered for the solution of this problem, among them one for bringing the water by gravity from the mountains of New Mexico. There are two distinct problems to be worked out in Oklahoma City: one a plan for insuring a proper supply for the immediate needs of the city, and the actual work be undertaken forthwith. The second is to devise a scheme that will be satisfactory for the city and will not retard the growth of the city should it continue to increase in population in the future at a rate approaching its rate of growth during the past decade.

MUNICIPAL AND TECHNICAL LITERATURE

Toronto City Engineer—City Magazine—Municipal and State Reports

The Toronto Engineer's Report.

The annual report of the city engineer of Toronto, Canada, is a very comprehensive, though compact, statement of the work undertaken and finished during the year 1909. Tables, maps and diagrams are used extensively in the publication. The latter, in particular, are extremely valuable.

In the diagram showing the classification of pavements different colors are used to represent the various kinds of pavements, and their relative prominence may be noted at a glance. Diagrams representing the relative merits of different brands of cements under the various tests are also given, and are greatly superior to tables requiring time and study for their comparison.

Another feature of the report is the account of work in the bridge department. The failure and repair of the lower chord of the Queen street bridge and the summary of impact tests on the Dundas street bridge are indicative of the care and thoroughness characteristic of the entire engineering department.

Municipal and State Reports.

The fifty-ninth annual report of the bureau of water of Albany, N. Y., in addition to a number of tables of costs, quantities, etc., of materials used, has an account of the experiments on double filtration at the city plant. The experiments are recounted in detail, and a number of tables are given summarizing the results.

The report of the Bangor water board for 1910, in addition to the usual data on pumping, etc., contains a discussion of the filtration problem in Bangor, by Jas. M. Caird, chemist and bacteriologist. The subject of the use of various coagulants is entered into fully and the difficulties of mixing, quality of chemicals and methods of application are briefly recounted.

The annual report of the Massachusetts highway commission is divided into two parts. The first part concerns itself with state highways, their maintenance and improvement, giving especial attention to the treating of roads with tar and oils to offset the wear of automobile tires. The second part is devoted to the supervision of telephone and telegraph companies. Appendices contain statistical data on various individual corporations.

The report of the city engineer of Milwaukee contains a number of photographs of street bridges in that city. These, with accounts of tests of pumping engines at the North Point station, and costs of operation of pumps, are unique features of the report.

The annual report of the city comptroller and treasurer of Minneapolis, Minn., is exceptionaly well prepared, full details being given of all items.

A Creditable City Magazine.

The November issue of *The Live Wire*, of Buffalo, N. Y., is the first of a new type of "booster" magazine for that city. The publication is an example of an up-to-date municipal paper and seems to have been correctly named. Mr. William S. Crandall, the editor, has had a wide experience in municipal editorial work and is well fitted to have charge of the publication.

ORGANIZATIONS AND INDIVIDUALS

Road Builders—Iowa Engineers—Illinois Engineers—Iowa Cement Users—N. A. C. U.—New York Cement Show—National Municipal League—Good Roads—Technical Associations—Technical Schools—Civil Service—Personal Notes

Iowa Engineering Society.

The proceedings of the Iowa Engineering Society for 1910 contain the following papers of interest: "Bitulithic Pavement at Grinnell, Ia.," by W. E. Beard; "Concrete Construction in Cold Weather," by J. H. Chubb; "Rates for Electric Service," by A. H. Ford; "The Direct Method in Illuminating Engineering," by L. B. Spinney. In addition to these papers, the reports of various committees are given in detail.

American Road Builders' Association.

The seventh annual convention of the American Road Builders' Association will be held at the German House, Indianapolis, Ind., on December 6, 7, 8 and 9. In connection therewith will be held a congress of road builders and a "good roads show."

Among the speakers who have already accepted places on the program are the following: "Relation of the City to Its Adjacent Country Highways," A. B. Lea, Director Public Service, Cleveland, Ohio; "Some Features of Road and Bridge Construction, A. N. Johnson, State Highway Engineer of Illinois; "History of Roads in Province of Saskatchewan," F. J. Robinson, Deputy Minister of Public Works, Province of Saskatchewan, Canada; E. J. Watson, Commissioner of Agriculture of South Carolina; "Present Highway Laws of Ohio and the proopsed New Law," James C. Wonders, State Highway Commissioner of Ohio; "The National Grange and Good Roads," N. J. Bachelder, Master of the National Grange; S. Percy Hooker, Chairman New York State Highway Commission; C. D. Miller, Assistant Territorial Engineer of New Mexico; "Application of the Highway Law of Pennsylvania," Jos. W. Hunter, State Highway Commissioner of Pennsylvania; "Progress of Road Building in Michigan," Townsend A. Ely, State Highway Commissioner of Michigan; "State Highway Legislation," Logan Waller Page, Director U. S. Office of Public Roads; Geo. W. Cooley, State Engineer of Minnesota; "A Division of Road Interests for Better Results," Major W. W. Crosby, Chief Engineer, Maryland State Roads Commission; Harold Parker, Chairman Massachusetts State Highway Commission; "Convict Labor," Samuel Hill, President Washington State Good Roads Association; "Earth Roads," Charles P. Light, Commissioner of Roads of West Virginia; "The Best Method of Supervision and Control of Road Construction in a State," Jos. Hyde Pratt, State Geologist of North Carolina; "Road Building in South Dakota," Samuel H. Lea, State Engineer of South Dakota; "Road Building in North Dakota," T. R. Atkinson, State Engineer of North Dakota; Paul D. Sargent, State Highway Commissioner of Maine; Col. Frederick Gilkyson, Commissioner of Public Roads of New Jersey; W. O. Hotchkiss, Chief of Highway Division, Geological Survey of Wisconsin; P. St. J. Wilson, State Highway Commissioner of Virginia; "Bridge and Culvert Construction," W. S. Gearhart, State Highway Engineer of Kansas; James H. MacDonald, State Highway Commissioner of Connecticut.

The membership of the American Road Builders' Assosciation includes the foremost road-making and street-paving authorities of the United States and Canada, men occupying the chief administrative and engineering positions in the highway departments of states, counties, cities and towns. The experience of these men embraces work with all the materials and methods used in the construction of country roads and city streets and the building of highways under all the varying conditions encountered throughout the country. The opportunities afforded by the convention of the association to learn from these men, both through the papers prepared and presented by them and by personal meeting with them, render the annual convention of the American Road Builders' Association one of the chief events of the year in road-building circles.

Following the custom inaugurated last year at the sixth annual convention at Columbus, O., the exhibition of materials and machinery will form an important feature of the convention. Ample exhibition space has been obtained in the German House and the grounds connected with it, thus bringing the meetings and the exhibits together and facilitating attendance upon both without the loss of time. The exhibits will include the various materials and the most improved machinery and appliaances for road making and street paving. The greater number

of exhibits will be shown in the German House, while the larger and heavier machinery will be displayed in the adjacent grounds.

The meetings and exhibits will be open to the public and a general invitation is extended to every one interested in any branch of highway work. The headquarters of the association are at 150 Nassau street, New York City.

Iowa Cement Users.

The seventh convention of the Iowa Association of Cement Users will be held at Cedar Rapids, Ia., January 10 to 13, 1911. The program will include a discussion of the cement tile problem by Prof. A. Marston, of Iowa State College; an illustrated lecture on bridge and culvert work, supplied by the Iowa Highway Commission; a paper on cement street paving, by C. P. Chase, C. E., of Clinton, etc. The convention sessions will be held in the morning of each day and the cement show will be open afternoon and evening.

The Illinois Society of Engineers and Surveyors.

The twenty-fifth annual report of the Illinois Society of Engineers and Surveyors contains an unusually large number of papers concerning municipal problems. Among them were the following: "Municipal Engineering in Cairo, Ill.," W. B. Thistlewood; "Tests of Simple Surveying Instruments," by Prof. J. T. Stewart, of Minnesota State University; "Municipal Ownership of Public Utilities," by J. W. Dappert, Taylorville, Ill.; "Recent Practice in Sewage Purification," by W. D. Gerber, 1200 Hartford building, Chicago; "Sewage Testing Plant of the Sanitary District of Chicago," by Langdon Pearse, Chicago; "Sewage Disposal for Small Institutions" and "Hydraulic Engineering at the University of Illinois," by G. C. Habermeyer, Champaign, Ill.; "Chicago's Sidewalk Practice," by N. E. Murray, 120 Clarke avenue (Austin); "Workmanship vs. Materials in Street Paving," by W. W. Marr, 300 City Hall, Chicago; "Earth, Gravel and Macadam Roads," by M. O. Eldridge, chief of department of highways, U. S. Agricultural Bureau, Washington, D. C.; "Testing of Road Materials" and "Instruction in Road and Pavement Construction at the University of Illinois," by R. B. Slippy, Waterloo, Ia.; "Good Roads in Central Illinois," by J. O'Brien, Champaign, Ill.; "Cost Data for Reinforced Concrete Highway Bridges," by A. N. Johnson, state highway engineer, Springfield, Ill.; "Relation of Typhoid Fever and Water Supplies" and "Surface Water Supplies of Illinois," by E. Bartow, University of Illinois, Champaign, Ill.; "Reinforced Concrete Aqueduct Lining," by H. E. Reeves, Atkinson, Ill.; "Water Supply and Drainage Investigation of the Illinois Co-operation," by R. I. Randolph, 748 First National Bank building, Chicago.

In addition to these papers of immediate interest to the municipal engineer, there were several other papers, and a number of discussions of interest and value to engineers in general. The next meeting of the society will be held in East St. Louis in January, 1911.

National Association of Cement Users.

The seventh convention of the National Association of Cement Users will be held in Madison Square Garden, New York, on December 12 to 16, in connection with the New York Cement Show, which is held December 14 to 20.

The sectional committees will meet at 2 p. m. of Monday, the 12th, and that on roadways, sidewalks and floors will discuss the preparation of materials, laying, finishing and costs. The formal addresses of welcome will be delivered in the evening, followed by a business session and papers on "Dustless Concrete Floors," by L. C. Wason, of Boston, Mass.; "Some New Methods in Sidewalk, Curb and Gutter Construction," by Jerome B. Landfield, Binghamton, N. Y., and the report of the committee on sidewalks, roadways and floors, by C. W. Boynton, chairman.

On Tuesday morning, December 13, there will be a meeting of the section on concrete and reinforced concrete, with a general discussion on selection of materials, methods of construction, costs, etc., followed by the regular session, at which will be presented the report of the committee on reinforced concrete and building laws, by A. E. Lindau, chairman, and papers on "Web Reinforcement of Concrete Beams," by Peter Gillespie, University of Toronto, Canada, and Major John Stephen Sewell, consulting engineer, Gantts Quarry, Alabama; "Flat Slabs of Reinforced Concrete," by Arthur N. Talbot, University of Illinois, Urbana, Ill.; "Discussion of Flat Reinforced Concrete Plates," by Angus B. MacMillan, Boston, Mass.; "Analysis of Results of Load Tests on Panels of Reinforced Concrete Buildings," by Emile G. Perrot, architect, Philadelphia, Pa.

In the evening will be given the annual address by the president, and papers on "A Comparison of the Concrete Industry in Europe and America," by Dr. Otto Schott, director, Offenbach Plant, Heidelberg and Mannheim, Portland Cement Company, Heidelberg, Germany; "The National Fire Protection Association and Its Work," by W. H. Merrill, president, Chicago, Ill., and "Some Thermal Properties of Concrete," by Prof. Charles L. Norton, Massachusetts Institute of Technology, Boston.

This will be followed by a business session, with report of executive board, determination of place of next convention and election of officers.

On Wednesday morning, December 14,

the sections of fire-proofing and insurance will hold a topical discussion on fire resistive construction of buildings and the effect on insurance rates, followed by the report of the committee on fire-proofing, by Rudolph P. Miller, chairman; the report of the committee on insurance, by William H. Ham, chairman, and papers on "An Incident of Value of Concrete in Reducing Cost of Insurance," by Emile G. Perrot, Philadelphia, Pa., and "Effect of Electrolysis on Metal Imbedded in Concrete," by Cloyd M. Chapman, New York, N .Y.

The evening session will have papers on "Construction Problems of the Aziscones Concrete Gravity Dam," by Seth A. Moulton, Portland, Me.; "Preparation and Handling of Concrete," by H. M. Cryder, St. Louis, Mo.; "Advantages and Comparative Cost of Spouting Concrete," by F. E. Engstrum, Los Angeles, Cal.; "The Use of Compressed Air in the Handling of Mortars and Concrete," by G. L. Prentiss, New York.

For Thursday morning, December 15, is set the meeting of the section on specifications for cement products, which will discuss the manufacture, curing, cost, etc., of cement hollow building blocks, architectural concrete blocks, fence posts, drain tile and pipe. This will be followed by the report of the committee on specifications for cement products, by P. S. Hudson, chairman, in two parts, (a) "Proposed Standard Specifications for Architectural Concrete Blocks," (b) "Proposed Standard Specifications for Plain Concrete Drain Tile." Papers will follow on "General Considerations in the Construction of a Cement Products Plant," by Charles D. Watson, Syracuse, N. Y.; "Cement Tile Plant—Layout and Operation," by C. M. Powell, Universal Portland Cement Company, Chicago, Ill., and "Additional Notes on Steam Curing Plants," by F. S. Phipps, St. Joseph, Mo.

The reception and banquet will be held on the afternoon of Thursday.

Friday morning will have the meeting of the section on treatment of concrete surfaces, with a topical discussion on the artistic treatment of concrete surfaces of various kinds, followed by the general session, at which will be presented the report of the committee on exterior treatment of concrete surfaces, by L. C. Wason, chairman; proposed specifications for stucco on metal lath, and papers on "Comparative Cost and Maintenance of Various Types of Building Construction," by J. P. H. Perry, Turner Construction Company, New York, N. Y.; "Concrete Filled Arches," by H. H. Quimby, engineer of bridges, bureau of surveys, Philadelphia, Pa., and "Reinforced Concrete Sewers," by J. A. Hooke, assistant sewer commissioner, St. Louis, Mo.

In the evening there will be papers on "The Hudson Memorial Bridge," by William H. Burr, professor of civil engineering, Columbia University, New York, N. Y.; "Reinforced Concrete Construction in San Francisco and Vicinity," by John H. Leonard, San Francisco, Cal.; "Reinforced Concrete School Buildings," by John T. Simpson, Newark, N. J.; "The Use of Reinforced Concrete for Hospitals and Similar Structures," by R. A. McCullough, New York, N. Y., and "Advantages of Reinforced Concrete for Farm Buildings," by Alfred Hopkins, architect, New York, N. Y.

As noted elsewhere, the eastern railroad organizations grant a round trip rate of one and one-half fares, which those from points outside these districts, roughly west and south of New York and Pennsylvania, can avail themselves of by purchasing these tickets at the first station within the district.

The New York Cement Show.

The first annual New York Cement Show will be held in Madison Square Garden, New York City, on December 14-20. Advance notices indicate that it will eclipse all previous efforts along this line. Cement, aggregates, reinforcing systems, water-proofing methods, concrete mixers, concrete tile, block machines, coloring compounds, forms, ornamental concrete work and a complete representation of every article and appliance entering into the use of cement will be displayed. The show will be orderly and artistic in the best sense. Every possible effort will be made to make the exhibition as attractive as it is possible to make a show of this character. Two hundred and fifty exhibitors will have displays of vital interest to the trade.

The publicity committee of the Association of American Portland Cement Manufacturers are arranging for a most interesting series of addresses, to be delivered in the concert hall of Madison Square Garden during the New York Cement Show. A number of very prominent speakers have already consented to appear, and Mr. Albert Moyer is conducting negotiations with a number of other men of national reputation.

Thus far addresses have been secured from the following men upon the subjects mentioned: Rudolph P. Miller, building commissioner of New York City, on "Fire-proof Materials;" Calvin Tomkins, commissioner of docks and terminals, on "Transportation Terminals;" Logan W. Page, director of the Office of Public Roads, United States Department of Agriculture, on "Rural Highways;" C. P. Goodrich, consulting engineer of the city of New York, on "Important Reinforced Concrete Structures."

This series of talks will be made afternoons and evenings during the show. A large number of interested people will receive special invitations to attend, although the meetings will be open to any who want to hear the lectures.

On account of the annual convention of the National Association of Cement Users, which will be held in New York during the cement show, December 14-20, the railroads in the Trunk Line Association, the New England Passenger Association and the Eastern Canadian Passenger Association have made a reduced rate of a fare and one-half from all points from which going tickets are 75 cents or more.

The Annual Convention of National Municipal League.

The sixteenth annual convention of the National Municipal League was held at Buffalo, N. Y., November 14 to 17. This organization is devoted to municipal reform in its broader constructive aspects, as related to measures rather than particular men. It now has a membership of more than 2,000, having made notable increases during the past few years. For some seven years past it has been under the presidency of the Hon. Charles J. Bonaparte, a member of the cabinet of ex-President Roosevelt. At the convention just closed Mr. Bonaparte was succeeded by the Hon. William Dudley Foulke, of Richmond, Ind., formerly United States Civil Service Commissioner. The secretary of the league, Mr. Clinton Rogers Woodruff, of Philadelphia, was continued in office.

Among the subjects discussed during the convention were the municipal franchise question, city budgets, finances and statistics, and the commission form of government. A variety of other phases of municipal government and administration were brought before the convention by means of formal papers, committee reports and informal discussion at the "round table" luncheons held each day.

Good Roads Association.

The national convention of the Good Roads Association, which met at Oklahoma City, Okla., October 4, 5 and 6, adopted the following resolutions:

Resolved, By the delegates to the eleventh National Good Roads Convention, from Alabama, Idaho, Illinois, Kansas, Minnesota, Missouri, New York, Ohio and Texas, in convention assembled at Oklahoma City, October 4, 5 and 6:

That the cost of permanent highway construction and maintenance should be paid jointly by the county, state and nation, and that the national government should make a reasonable appropriation for such purpose, and we urge upon every voter to oppose any candidate for the state legislature or the national congress who will not pledge himself to work for such national aid for post roads.

We believe that the vast annual expense for war preparations is excessive. Why not use half of this fund for good roads? We also believe that from experience convict labor, where just'y used, is a great benefit to the construction of public roads, and advocate such under the system now prevailing in Colorado.

Several interesting papers were read advancing ideas in regard to road building and proper road construction. The principal address delivered was by B. F. Yoakum, chairman St. Louis & San Francisco Railroad Company, on the second day, October 5.

Technical Associations.

The 1910 volume of proceedings of the Indiana Engineering Society is unique in the field of society publications. Almost all of the papers given are profusely illustrated by photographs or drawings, adding materially to the interest and value of the subjects presented. Prof. Howe's historical paper on arch bridges is especially well illustrated, about thirty different photographs of bridges of note being reproduced.

The annual publication of the Connecticut Society of Civil Engineers contains the following articles of interest to those engaged in municipal work: "Eight Weeks' Civic Study Abroad," by F. Luther Ford, city engineer of Hartford, Conn.; "Dams Approved by Mr. Henry T. Potter," by Chas. E. Chandler, city engineer of Norwich, Conn.; "The Sea Wall in Connection with Power Stations and Manufacturing Buildings," by Geo. A. Orrok, 55 Duane street, New York City.

The thirteenth annual convention of the League of California Municipalities was held in San Diego, Cal., on November 16, 17, 18 and 19.

A paper on "Engineering Work by the Bureau of Sewers in Brooklyn Borough" was presented by Mr. James B. Van Vleck, at a regular meeting of the Brooklyn Engineers' Club, on November 10.

A paper entitled, "Some Problems in Sewage Disposal of New York," was presented by Col. W. M. Black, Corps of Engineers, U. S. A., at a meeting of the Municipal Engineers of the City of New York, held November 23.

The eleventh annual meeting of the National Civic Federation will be held January 12, 13 and 14, 1911, in New York City. The important topics of the hour, in which the Federation has been especially interested and which will be considered, are: Regulation of corporations and combinations; regulation of railroads and municipal utilities; compensation for industrial accidents; arbitration and conciliation.

A "city planning conference" was held on November 14, 15 and 16, in Los Angeles, Cal. Papers were read on various phases of the city planning question.

The next annual meeting of the Indiana Engineering Society will be held January 12, 13 and 14, at Indianapolis, at the Denison Hotel. A feature of same will be the annual exhibit for manufacturers of anything of interest relating to the engineering profession. Space for ex-

hibit can be secured on application to the secretary, Union Trust building, Indianapolis, Ind.

The annual meeting of the Canadian Society of Civil Engineers will be held at Winnipeg, Man., on January 2-6. Secretary C. H. McLeod, 413 West Dorchester street, Montreal, Que.

At the meeting of the Engineers' Club, of St. Louis, on November 11, Mr. Mont Schuyler, engineer in charge of the city testing laboratory of St. Louis, presented a paper entitled "Certain Theoretical Aspects of Specifications."

The Technical Schools.

The students of the School of Engineering of the Pennsylvania State College are at work instal'ing a wireless telegraph station in the buildings devoted to electrical engineering. With this apparatus they will communicate with stations at Washington, New York, Philadelphia, Boston and elsewhere. The same institution has erected buildings and installed a great calorimeter, 12x12x12 feet, to be used in testing the heat conducting characteristics of various forms of building construction and materials. In connection with this calorimeter are an ice plant and a heating plant for the purpose of properly regulating the temperatures. Tests of the kind specified should be of great service for determining the proper form of building construction, and for accurately designing heating and ventilating plants.

Bulletin No. 379, of the extension division of the University of Wisconsin deals with the commission plan of city government. Bulletin No. 388 is a preliminary announcement of the Institute of Municipal and Social Service in Milwaukee.

"The Effect of Keyways on the Strength of Shafts," by Herbert F. Moore, has just been issued as bulletin No. 42 of the Engineering Experiment Station of the University of Illinois. This bulletin gives the results of tests to determine the relative strength of solid shafts and of shafts with keyways. A table showing power transmission by cold-rolled shafting with keyways and a diagram illustrating the weakening effect of keyways are given.

On November 12 occurred the dedication of several new buildings for the department of practical mechanics of Purdue University, at Lafayette, Ind. These buildings accommodate the department of practical mechanics and provide facilities for instruction in mechanical drawing, descriptive geometry and shop work. The main building contains 25,000 square feet of floor space, can accommodate at one time 400 students in drawing, and has locker accommodations for 1,200 students. The lecture room seats 300 and there are two class rooms, each having a capacity of sixty students. The shops cover 43,000 square feet of ground and are capable of accommodating a group of 350 students at one time. The machines, tools, benches, lockers—in fact, all the details of the equipment are modern, while many of the special features are unique. The buildings, as a whole, constitute what is probably the largest and most completely equipped plant for the instruction of students in shop practice and drawing in this country and represent the accumulated experience of twenty-five years at this university.

Civil Service Examinations.

The United States Civil Service Commission announces examinations at the usual places, as follows:

Dec. 7: Fortification draftsmen, at a salary of $1,500 per annum, and cartographic draftsman at $3.84 per diem.

Dec. 7: Superintendent of construction, U. S. Penitentiary, McNeil Island, Wash., at a salary of $5 per diem.

Personal Notes.

John A. Dent, recently with the oil pipe line service of the New York Transit Company, has been appointed instructor in mechanical engineering at the University of Illinois.

H. B. Dirks, instructor in mechanical engineering at the University of Illinois, has resigned to accept a position as assistant to the general manager of the National Machinery Company, Chicago, Ill.

Dr. Allerton S. Cushman, assistant director of the Office of Public Roads, U. S. Department of Agriculture, has resigned, and will establish a laboratory in Washington, D. C., for the purpose of engaging in original research.

Mr. Walter Brinton, formerly superintendent of the manganese steel department of the Taylor Iron and Steel Company, at High Bridge, N. J., has become consulting engineer for the Edgar Allen American Manganese Steel Company, at New Castle, Del.

Mr. George E. P. Smith, Assoc. M. Am. Soc. C. E., irrigation engineer at the Agricultural Experiment Station at the University of Arizona, is taking a year's leave of absence to make investigations in irrigation and hydraulic engineering at the University of Wisconsin.

E. Stutz has retired as vice president and general manager of the Goldschmidt Thermit Company. The affairs of the company will henceforth be conducted by Mr. William C. Cuntz, as general manager and treasurer. Dr. F. H. Hirschland has been elected vice president.

Mr. John A. Bensel, president of the American Society of Civil Engineers, has been elected state engineer of New York on the Democratic ticket, succeeding Mr. Frank M. Williams, Republican. Mr. Bensel is at present president of the board of water supply of the city of New York.

Mr. D. W. Dedrick will have charge of the newly established work in milling engineering in Pennsylvania State College. Mr. Dedrick has designed, built and operated some of the largest flour milling plants in the country. He has contributed much valuable matter to the technical press, and he is ex-president of the National Association of Millers. The

preparation of technically trained men for the milling industries is a new educational development, but is one which bids fair to be of great service to the country.

Prof. Joseph Baker Davis, who has been a member of the faculty of the engineering department of the University of Michigan since 1872, resigned recently. In recognition of his services to the university the board of regents, upon accepting his resignation, made him professor emeritus.

Alfred Noble is the first civil engineer to receive the John Fritz medal, the highest honor at the disposal of American engineers. The medal was established by the professional associates and friends of John Fritz, of Bethlehem, Pa., on August 21, 1902, his eightieth birthday, to perpetuate the memory of his achievements in industrial progress. It is awarded by a board of sixteen, made up in equal numbers of members of the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. It is awarded for notable scientific or industrial achievement and there is no restriction on account of nationality or sex.

MACHINERY AND TRADE

The G-K Sewer Pipe Inspector.

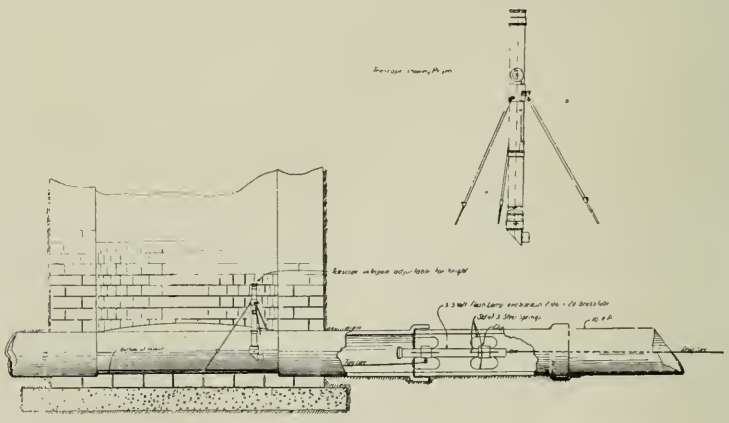
The difficulty of making the needed inspections of small sewers is appreciated by every one whose duty has led them to assume a cramped and tiring position over a manhole, watching in a mirror held at the opening of a sewer, to catch the reflection of the sunlight in another mirror held at a manhole some distance away. Under the best of conditions this method of inspection is applicable to a very limited length of sewer, and practically the only satisfaction obtained is to locate an obstruction approximately.

Mr. W. W. Dixon, engineer of the Union Clay Products Company, 50 Church street, New York, has applied for a patent on an appliance which he used with great success in the city of Summit, N. J. This apparatus consists of a traveling light and a telescope for observation.

The light consists of an electric hand torch, either carrying dry batteries or else furnished with a long wire connecting it to a storage battery. The light is protected by two sets of springs, three springs to a set, so arranged as to hold the light away from the side of the sewer as it is being drawn through it.

The method of operation is very simple. The light is dragged through the sewer, and attached to it is a steel tape, which is paid out from the point of entrance, so that when an obstruction, break or leak is discovered and illuminated, reference to the tape will locate it exactly. The front of the bulb of the lamp is silvered, so as to overcome the glare from the light.

To avoid discomfort to the observer, Mr. Dixon has devised a telescope, so arranged as to make it unnecessary to as-



G. K. SEWER INSPECTOR.

sume a cramped position. The telescope, with a power of about fifteen diameters, is equipped at the object end with a right-angled prism, so set as to reflect all rays coming at right angles to the axis of the telescope. The telescope is mounted on a tripod with adjustable legs, so that it may be set up regardless of irregularities in the bottom of the manhole. A rack and pinion adjustment is provided for adjusting the telescope so as to receive the rays from the lamp directly along the axis of the sewer.

Mr. Dixon has used the apparatus to detect flaws, leaks, breaks, obstructions, etc., in sewers, as well as in making inspections of new pipe lines previous to their acceptance by the city.

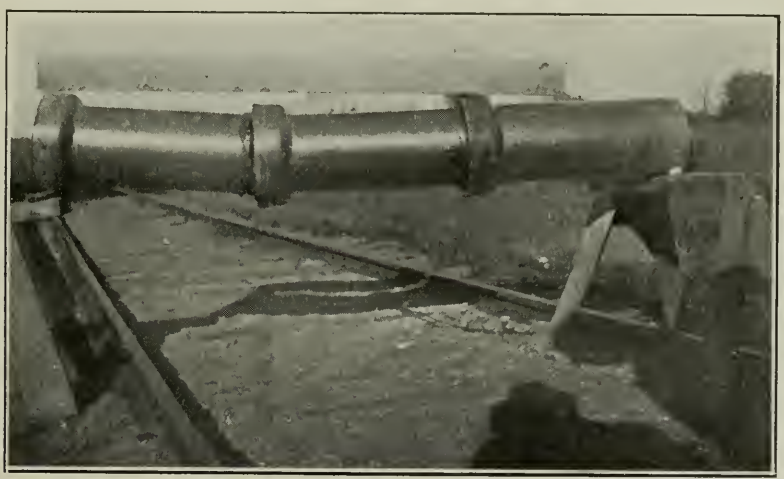
A Successful Water-Tight Sewer Joint.

A sewer joint packing allowing of greater flexibility between the pipe sections has recently been placed on the market. It permits a marked settlement of a pipe joint without any resultant leakage. This material consists of linseed oil vulcanized with sulphur, mixed with clay. When used the material is heated to about 300 degrees and poured as would be a lead joint in water pipe. In pouring it a short length of rubber hose may be used instead of the asbestos runner ordinarily used for water mains, the hose being rubbed with a greasy material, as it is found that the joint material does not adhere to grease, but does adhere to asbestos or to clay or other moist substances. In fact, one of the peculiarities of this substance is the fact that it adheres to wet pipe, probably removing the moisture in the form of vapor produced by the heat of the mixture. The material is known as G-K sewer joint compound, and is manufactured by the Union Clay Products Company, of 50 Church street, New York.

The results obtained by the use of the material are mentioned in a report of Mr. W. C. Van Duyne, chief engineer of the East Orange and Ampere Land Company. An abstract of this report is given as follows:

The system we are building at present comprises about 15,000 feet of 8 and 10-inch sanitary sewers. In making the calculations we allowed for an infiltration of 33 per cent. Sulphur joints were used exclusively, and we took all precautions possible, even to coating the finished joints with cement.

The property here is that formerly owned by the Orange Water Company, and is that from which East Orange used to pump their entire water supply. Naturally the ground is very water soaked, the water table rising to within 2 feet of the surface in many points. Our storm sewers are as yet not completed to the point where they will reduce the water table to any appreciable amount.



TEST OF G. K. WATER TIGHT SEWER JOINT.

About a month ago I saw that I was going to have an infiltration of over 33 per cent. on the whole system. Some of our sewers were placed within 6 inches of quicksand. Within the last two weeks we have laid two stretches of 8-inch pipe, using G-K compound in the joints, one in a 12-foot trench and the other in a 2-foot trench. The pipe line in the 2-foot trench has been standing for a week and a half now, with about 1 foot of water over the top of the trench. The late rains converted that section into a pond, and I have not had the water drawn off, since I wished to see what effect it would have on the sewer. As yet I have detected no infiltration. The section in the 12-foot trench is giving equally as good results.

We are taking care to have the G-K compound very hot, probably 500 to 600 deg. F., before pouring it, as was suggested. We find that the joints are made more readily, and that any moisture which may be in the pipe is driven out and a perfect bond made. The joints are made with much more ease than the sulphur joints were made.

Some interesting tests of the joints were made recently by the city of Summit, N. J., under the direction of Mr. L. A. Oaks, superintendent of streets and sewers. Two 3-foot lengths, deep and wide socket, 8-inch pipe, were laid level and caulked with two strands of yarn, joint runner placed, the compound then heated and poured in the usual manner. After cooling, the ends were plugged with rubber sewer plugs, with ½-inch pipe connection to city water on one end and steam gauge on the other. The water was turned on, and the gauge showed 22 pounds, at which pressure one of the end plugs came out. In about five minutes after replacing plug the pressure was held at 20 pounds for some time and no leak could be found, or sign of weakness. This pipe was then placed on the floor, with 4-inch blocks under each end of the pipe, and left until the next day with some extra weight on the center or bell. By this time the pipe had deflected about 2 inches. The water was left in the pipe for several days and no leaks appeared. Some weeks afterward this pipe was reversed and became straight, and is still fast and firm in the joints.

The result of a similar test may be noted from the accompanying photograph. In this case even under the extreme condition of two unsupported joints, no leaks could be detected in either.

Sprinkling in Rio Janeiro.

The city of Rio de Janeiro, the capital of Brazil, South America, is without doubt one of the most beautiful as well as finest organized cities of its size in the world. A few years ago this was not so. At that time the streets were for the most part narrow and unwholesome, the sanitation was of the worst and the transportation facilities were no better. Now it is a city of broad streets, up-to-date city transportation and fine buildings, with sanitary and lighting equipment of the best. This was all made possible through the broad-minded policies of the municipal authorities, who, when the reconstruction of the city was commenced, decided that all equipment was to be for the best and most practical use. The accompanying illustration shows part of an equipment of twenty-five Studebaker sprinkling wagons and harness which was furnished the city shortly after its reconstruction.

STUDEBAKER SPRINKLERS IN HANANA.

Capacity of Portable Asphalt Plant.

In the November issue of MUNICIPAL ENGINEERING a reference was made to the portable asphalt plant manufactured by the Link-Belt Company, of Chicago. In this article mention was made of the capacity of the plant, and in that connection a typographical error was overlooked by the proof-reader, giving an entirely wrong idea of the value of the machine. The paragraph in error should read as follows (page 410):

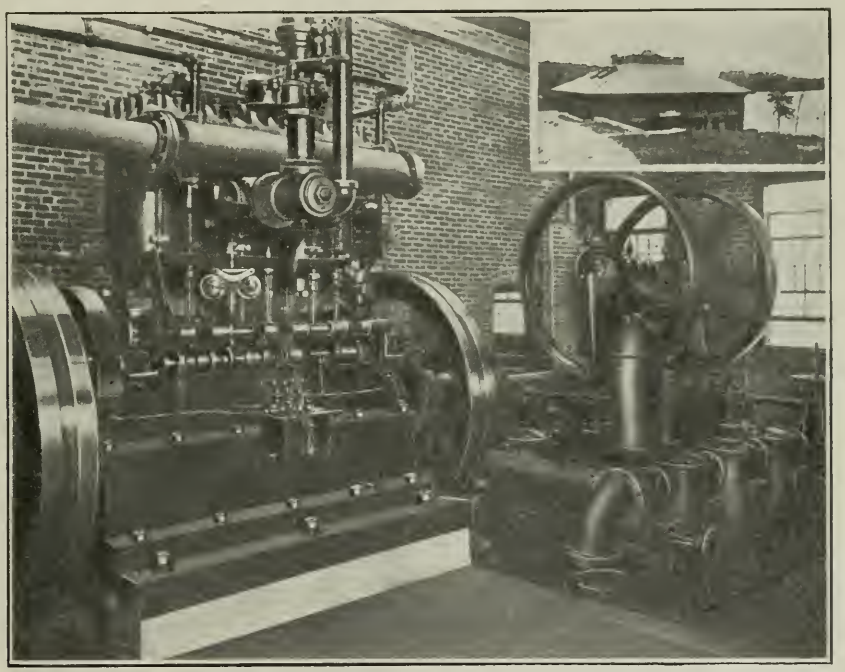
"The average capacity of the plant under normal conditions is conservatively rated at 800 square yards of 2-inch thick pavement per day of nine hours," etc.

Inasmuch as reports are frequently re-

ceived from users of this machine rating it as high as 1,300 to 1,400 square yards of 2-inch to 2½-inch pavement per day, it will be seen that 800 square yards per day is a very conservative rating.

The Gas Engine in Municipal Pumping Plants.

During the past few years several municipal pumping installations have been made in which the required power is derived from gas engines operating on fuel supplied by suction gas producers. In units up to 3,000,000 gallons daily capacity, or within sizes allowed by the triplex power pump makers, such installations have shown a degree of efficiency secured only by steam units of very large sizes.



THE NASH PUMPING ENGINE, USING FUEL GAS.

By the use of a triplex power pump showing an efficiency of 75 per cent. or over, a producer which will deliver to the engine 75 per cent. of the B. t. u. contained in the coal, and an efficient engine, a duty of approximately 150,000,000 foot pounds per 100 pounds of fuel is attained. This result is possible with units of a capacity as small as 350 gallons per minute. With the larger sizes slightly better economy is secured. Such a plant requires a minimum of attendance. The producer is charged once every ten hours, and if of the anthracite type, little care is necessary between periods of charging.

The installation shown is one of the units of the Manchester, Mass., plant, which consists of four 1,000,000-gallon units. The results secured have been highly satisfactory to the town. The installation was made by the National Meter Company, of New York, builders of the Nash engine. Triplex pumps are of the Gould's make, and the producers were furnished by the Smith Gas Power Company, Lexington, O.

The pumps are connected with the engines by means of friction clutches, which, with a by-pass gate on each pump, allow the greatest degree of flexibility in operation. The mechanical efficiency of the pumps is guaranteed to be from 80 to 85 per cent.

The routine work of starting and operating the plant is as follows:

First, the fire in the producers is cleaned; ashes are removed from the lower doors and the producer is charged with coal for the day's run. The producer is then closed, the ventilating pipe which runs through the roof is opened, and the fire blown up by an artificial draft.

Inasmuch as the gas is drawn to the engine from the producers by the suction of the engine pistons, it follows that in order to obtain a uniform flow of gas the engine must be in motion. This is provided by compressed air from tanks at a pressure of from 150 to 175 pounds per square inch. As soon as the cylinders are charged the explosions take place regularly, and the cylinder into which com-

pressed air has been admitted has its supply of air cut off and its connection with the gas line re-established, and it, in turn, receives explosions with the other two.

With the engine in operation, the proper combination of gas and air to provide an explosive mixture is obtained by the proper manipulation of the valves upon the engine. These require considerable care and judgment in operation, especially when the fire in the producer is new or the atmosphere extremely humid. Experience renders the operators extremely skillful.

The mixture is exploded in the cylinders in starting by a current from storage batteries, and as soon as the engine is running smoothly the storage batteries are cut off, and the current is furnished by a magneto belt driven from the engine. This magneto is connected with the storage batteries in such a way that the excess of current furnished by it over that required by the engine for ignition is "floated" upon the storage batteries. The guarantees of fuel economy from the three contractors for machinery were such that at full load and on a ten-hour run, with the plant lying idle or "standing over" for fourteen hours, a brake horse power could be generated at an expenditure of one pound of coal, of a heat value of at least 1,250 B. t. u. The plant has a sufficient reserve power to save in the depreciation due to wear and tear.

The American Service Company.

The management of the Pittsburg Engineering Agency have formed a business company to take over the foreign and territorial business and representation service of the Associated Bureau System, comprising the Bureaus of Technical References, American Trade Catalogs, Engineering and Industrial Research, to be operated under capable technical management and under the name of the American Service Company, with offices in the Bessemer building and associated agencies at all industrial centers. The first named bureaus are at the convenience of the engineering profession and industrial operators gratis. Correspondence with the chairman of the executive committee is always invited.

The Application of Oil to Highways.

The general popularity of the oiling treatment as a means of laying dust and preventing raveling has led to an increased effort to obtain a satisfactory method of applying the oil. The practical machine for this purpose must be able to distribute readily the various tar and asphaltic products which are on the market. Not only must it so control the flow that little or much can be spread upon the road, and so prevent waste of material, but the distribution must be even, to save the cost of hand brooming. With many machines it is a case of feast in one place and famine in the other. Puddles of oil on the roads not only bespatter and smear up vehicles and the clothing of their occupants, as well as pedestrians, but are also injurious to the road.

The Topping oiler, manufactured by Howell Topping, 50 Church street, New York City, seems to have overcome most of the difficulties encountered in the application of oil. This oiler may be attached to the ordinary sprinkling cart. It coats the road surface uniformly, with no puddles nor dry streaks, and it may be used with utility and value with either the light or the heavy oils of either tar or asphaltic base.

A full description of oiler and its use will be mailed upon application to Howell Topping.

Extensive Paving Contracts in Jackson, Miss.

On October 4 the city of Jackson, Miss., received proposals for the paving of 25,800 square yards of State street, one of the leading residential streets.

The prices for excavation ranged from 35 to 50 cents per cubic yard, and for foundation and surface, including five-year guaranty, the lowest bids for the several classes of pavement were as follows:

Asphalt, per square yard	$1.75
Bitulithic, per square yard	2.15
Creosoted wood block, per square yard	2.14

After careful consideration the council awarded contracts for bitulithic to the Southern Bitulithic Company.

Some dissatisfaction and talks of injunction were engendered by the unsuccessful contractors, but at a largely attended meeting of the taxpayers, held October 13, after full discussion, it was unanimously voted to approve the action of the mayor and council in awarding the contracts.

Correction of Erroneous Address.

Under an article entitled "The Gravity Carrier in Paving Work," on page 414 of the November number, reference was made to the Mathews Gravity Carrier Company, of Minneapolis. The address of the company mentioned is Merriam Park, St. Paul, Minn.

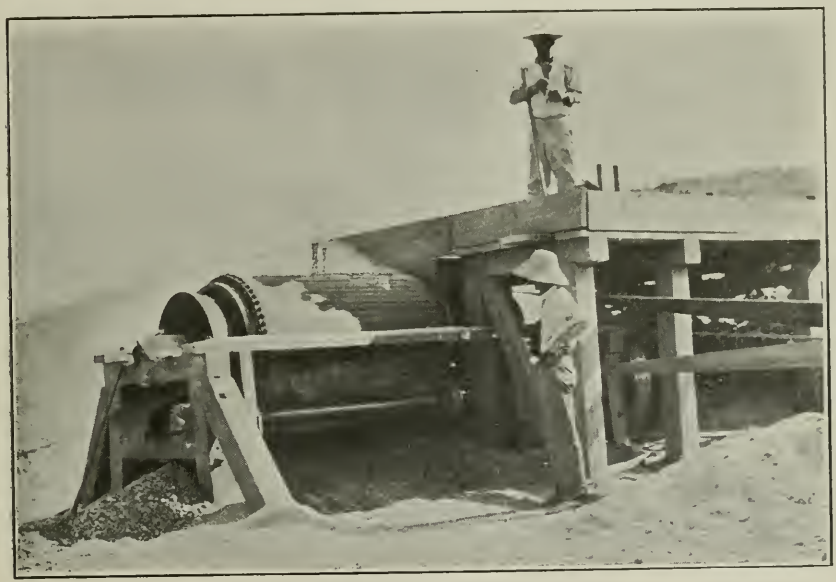
A Simple, Portable Crusher.

A rock crusher, simple in construction and operation, and easily transportable on the ordinary type of wagon, has recently been patented. The crusher was invented by Mitts Quenner, of Douglas, Ariz., for use in the Altas district of Sonora, Mexico. The character of the rock formations and the difficulty of transportation in this region made necessary a machine which should not only possess the great-

est strength, but should also be easily transferred as required.

The machine designed by Mr. Quenner is now being manufactured and used extensively in a number of lines of crusher work. An accompanying photograph shows the crusher in use in Mexico. As will be noted, no special foundation is required, and no preparation is needed other than setting the machine and connecting it to the driving power. A 20-h.p. gasoline engine will provide sufficient power to crush from twenty to thirty tons of hard material per hour to one-eighth mesh. This output has been attained daily in actual work, and the machine has not yet been run to its full capacity. It is said to do the work of a hundred-stamp mill at about one-tenth the cost of installation.

The use of the machine in concrete work, where a stone aggregate is used, is particularly to be recommended. It produces a sharp rock at the rate of thirty tons per hour and with a minimum quantity of fines. Its capacity and portability make it of great value in most classes of large concrete work. These two valuable features will also be appreciated by the road builder engaged in the construction of macadam roadways. By simple adjustments of the machine the rock may be crushed in sizes grading from 3 inches to ¼ inch. Its low cost of operation should recommend it for this class of work. Its superior capacity at a low cost per ton of material handled, together with the low first cost, should be carefully investigated by any one considering the purchase of a crusher. Full information and costs will be supplied upon application to the Quenner Dry Crusher Company, Singer building, New York City.



THE QUENNER ROCK CRUSHER.

Trade Publications.

The Steel City Electric Company, of Pittsburg, Pa., have issued a special illustrated bulletin describing the Fullman adjustable water-tight floor outlets.

The Barron & Cole Company, Barron building New York City, have an illustrated catalog describing the rock-crushing machinery manufactured by the Eureka Stone and Ore Crusher Company, of Cedar Rapids, Ia. The same company has booklets describing and illustrating the Nims concrete machinery, the Maney four-wheel scraper and Doud's "Acme" center dump and controllable discharge buckets.

Catalog No. 3, of the Union Iron Works, of Hoboken, N. J., contains prices, descriptions and illustrations of the various types of contractors' supplies manufactured by the company. These include about 150 different articles ranging from wheelbarrows to pile drivers.

The Engineering Agency, of Chicago, has a new catalog for distribution describing engineering and drafting supplies.

An illustrated booklet giving views of the factory of the Crown, Empire, Nash and Gem water meters is issued by the National Meter Company, of 84 Chambers street, New York City. The same company has a "Blue Book" entitled "High Quality versus Low Price." The

latter also concerns the types of meters above mentioned.

The Chicago Portland Cement Company, of Chicago, is distributing a "Concrete Weather Bulletin," warning contractors against the approaching cold weather. A copy of this bulletin is attached in the form of a tag to every other sack of cement sent from their plant.

The Elmer P. Morris Company, 90 West street, New York City, the "Outdoor Lighting Specialty House," have recently issued an artistic catalog, No. 19, covering street lighting brackets, in which many attractive designs are illustrated.

The National Meter Company, 84 Chambers street, New York, has just issued a handsome new catalog showing their Nash gas and gasoline engines. The catalog shows the latest designs and improvements in the construction of their engines, and the information it gives will be found valuable to all power users, and the chapters on producer gas and its economy as a fuel should be understood by all. The National Meter Company will gladly advise any one interested in this phase of power requirement.

The fourth edition of Kahn System Standards, just issued, contains a number of additions and revisions so as to include the best and most modern ideas on reinforced concrete designing and estimating, water-proofing, etc. The subject of water-proofing has been completely rewritten and entire new sets of tables for hooped columns and footing added. This publication also contains data on the various Kahn system products for reinforced concrete, steel lath, fire-proofing, steel windows, etc.

The Standard Pavement of the World is the title of a handsomely illustrated book descriptive of pavements made from Trinidad lake asphalt.

The Economy Drawing Table Company, of Toledo, O., has an illustrated catalog of many different types of drawing tables.

"Acme" (Nestable) corrugated metal culverts are briefly described in a series of leaflets from the Canton Culvert Company, of Canton, O.

A reprint of the decision of the case concerning the patent right on the Dunham steam radiator trap is being distributed by the National Vacuum Heating Company, of Marshalltown, Ia.

Bulletin No. 4025, of the Allis-Chalmers Company, Milwaukee, Wis., briefly describes a new motor-driven air compressor, with a few of its applications to various lines of work.

A report concerning the use of "Pioneer" reservoir water-proofing asphalt, in Pensacola, Fla., is given in a folder issued by the American Asphaltum and Rubber Company, of Chicago.

The November number of the bulletin issued by the Universal Portland Cement Company has an especially valuable article by Mr. J. H. Chubb, assistant inspecting engineer of that company. This article deals with the handling of concrete during cold weather. It endeavors to show how entirely useless it is to abandon all work, force men and superintendents to idleness and lose the interest on capital invested, where a measure of caution and the proper handling of materials, together with only a small increased outlay for extras, will make it possible to carry on work throughout most of the winter season. Other items of interest and value are to be found in the bulletin.

The Koehring Machine Company, of Milwaukee, have issued a thirty-page booklet, called "The Mixer," which contains a number of photographs of the interior of the plant where Koehring concrete mixers are made. The greater portion of the booklet is given up to saws, sayings and witticisms commonly attributed to "a good mixer."

The above title is given to an exceptional book published for the Stone & Webster Engineering Corporation, of Boston, Mass. The book is well bound, and the illustrations showing different steam power stations are excelelnt in every particular. A half-tone of each of the stations described is given on the right-hand page, while a description and plan view are given on the left.

Trade Notes.

MACHINERY AND SUPPLIES.

The Bush patent centrifugal pumps, until recently manufactured by Jesse Craft, of New York, N. Y., are now in new hands, and are being manufactured solely by the Greaves Specialty Company, 606 Tribune building, New York, N. Y.

PURCHASE OF MACHINERY.

Seattle, Wash.—Bids are requested Dec. 13 for the sale of the following: One Holly pump, capacity 5,000,000 gals.; two Worthington pumps, 2,000,000 gals capacity each; two Worthington pumps, 1,000,000 gals. each; one Dow pump, capacity 2,000,000 gals.; one Dow pump, 1,250,000 gals.; one Dow pump, 500,000 gals.; six 16-ft. tubular boilers, capacity 95-h.p. each; one 16-ft. boiler, capacity 75-h.p. C. B. Bagley, sec. bd. of pub wks., city hall.

Atrovelle, Ark.—Bids are requested on chemical fire engine. C. S. Peck, cy. clk.

MISCELLANEOUS.

Mr. Nicholas S. Hill, Jr., maintains a chemical, physical and biological laboratory in connection with his engineering office at 100 William street, New York City. He is prepared to make bacteriological and microscopical examinations of water and sewage, chemical analyses of water, sewage, sand, coal, oil, cement and alloys, calorific determinations of the heating value of coals, physical tests of sand and cement, special investigations and studies, and pumping engine and boiler tests.

Prof. A. H. Blanchard, of Brown University, Providence, R. I., will establish a consulting practice in highway engineering. Special attention will be given to

consultations, examinations, reports, designs, estimates and specifications relative to roads and pavements, systems of maintenance, highway bridges and the use of bituminous materials in the preservation of roads and the prevention of dust.

Kimball Brothers are located at Broadway, Flushing, New York. Mr. Kimball, the manager, has been associated with Mr. G. A. Roullier as field manager. The new firm is prepared to handle all kinds of surveys.

The contract for installing flashlight police system in Racine, Wis., was awarded to the Dean Electric Company, of Elyria, O., for $5,000.

The contract for furnishing pumps and machinery for the water works of Burlington, Ia., was awarded to the Erie City Iron Works, at $14,500.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Cullman, Ala.—It is reported that several miles of cement walks will be constructed.

Montgomery, Ala.—The paving with bitulithic of Madison ave. from Brainbridge st. to the city is contemplated.

Phoenix, Ariz.—Several miles of new road are to be constructed and extensive repairs will be made.

Helena, Ark.—The paving of Elm st., from Cherry to the Y. & M. C. tracks, will be begun as soon as brick can be secured.

Huntington Beach, Cal.—It is reported that the paving of Alabama, Arcadia and Magnolia aves. is contemplated.

Porterville, Cal.—The paving of Mill and Main sts., to Second, is contemplated.

San Francisco, Cal.—An ordinance providing for repaving of Mission st. with asphalt, cost about $56,000.

San Pedro, Cal.—A survey has been completed for a boulevard from the west basin to the outer harbor, and bids will soon be asked.

Fernandina, Fla.—The city has decided to pave Center st. from 5th to 11th sts., with vitrified brick.

La Grange, Ga.—Voted to issue $250,000 bonds for road improvements in Trop county.

Freeport, Ill.—City Engineer J. A. R. Daniels has prepared plans for 3 miles of brick and macadam pavement. Bids will be asked in January.

McHenry, Ill.—It has been decided to macadamize a number of streets of the town.

Chicago, Ill.—The paving of Cottage Grove ave., between E. 51st and E. 59th sts., is contemplated.

Chicago, Ill.—The board of local improvements has ordered Wabash ave. paved with creosote blocks, between Washington and Congress sts.

Chicago, Ill.—The paving of 5th ave., between S. Water and Van Buren sts., and of Wabash ave., between Washington and Congress sts., is being considered by the board of local improvements.

Springfield, Ill.—Paving and street improvements, to the extent of $100,000, are being considered by the board of local improvments.

Elkhart, Ind.—Paving is contemplated for 19 blocks in Oakland and California aves. A. M. Smith, cy. engr.

LaPorte, Ind.—Bids will soon be asked for the paving of Washington and State sts with brick.

LaPorte, Ind.—The board of county commissioners contemplates the construction of three miles of the Van Wilkinson gravel road. Clyde Martin, co. engr.

Cedar Rapids, Ia.—Paving amounting to $50,000 is contemplated.

Des Moines, Ia.—The city council has decided to make the following improvements: Paving West 35th st., from Grand ave. to Woodland; for extending the sewer on W. 33d st.

Waterloo, Ia.—The city council has passed a resolution providing for the paving of E. and W. 4th sts.

Coffeyville, Kas.—The Montgomery County Good Roads Association will build a 20-mile oiled dirt road to Independence.

Lexington, Ky.—Concrete sidewalks, curbs and gutters for Broadway and E. 3rd st. is contemplated.

Crawley La.—The city has decided to construct 33,000 sq. ft. concrete crossings. J. D. White, cy. engr.

Baltimore, Md.—Bonds in the sum of $1,000,000 have been voted for highway construction.

Grand Rapids, Mich.—Kent county supervisors have appropriated $45,000 to be available for construction of good roads next year.

Crookston, Minn.—Council rejected all bids for paving and directed the city engineer to prepare plans for paving 3rd st. with asphalt.

Lake City, Minn.—The construction of cement or concrete sidewalks is contemplated.

Owatonna, Minn.—Will vote Nov. 8 on the issue of $30,000 paving and sewer bonds.

Winona, Minn.—About $20.000 will be expended for brick paving. Paul Jasmer, cy. recdr.

Belzona, Miss.—Plans for about three miles of concrete sidewalks are being prepared and bids will soon be requested.

Springfield, Mo.—Resolutions have been passed for paving Lombard and Belmont aves. and N. Grant st.

St. Joseph, Mo.—The resurfacing of 8th and Mossins sts. with asphalt is contemplated; $15,000. Alfred Meier, pres. B. of P. W.

Seneca Falls, N. Y.—The citizens on Oct. 25 voted to issue $75.000 bonds for street improvements.

Akron, O.—Ordinances have been passed for paving High st. and Rhodes ave.

Cincinnati, O.—Ordinances have been passed providing for paving and surbing Whiteman st.; constructing concrete supporting walls and reinforced concrete steps in Baymiller and N. Elm sts.; macadaming, curbing and gutters in Probasco ave. John Galvin, pres. council.

Galion, O.—It is stated that about eight streets will be paved next spring.

Lancaster, O.—A resolution has been adopted authorizing the city engineer to prepare plans and specifications for paving Ewing st.

Portsmouth, O.—The city council contemplates paving all the principal alleys in the city next spring.

Toledo, O.—Concrete work is contemplated and bids will soon be requested.

Wellsville, O.—Plans for the paving of Virgin alley, from Riverside ave. to Broadway, have been approved by the city council.

Toronto, Ont.—Paving is contemplated for Wellesley Lane, Grand View, Hampton, Strachan and Pacific aves., Dovercourt road, Sackville and St. Vincent sts.

Zanesville, O.—An ordinance for paving Locust ave. has been passed. A. H. Correll, mayor.

Oklahoma City, Okla. — Resolutions have been passed for paving 17th, Olie and Wheeler sts.

Tulsa, Okla.—Bids will shortly be asked for the paving of about 85 blocks of streets, asphalt, at an estimated cost of $317,175. T. C. Hughes, cy. engr.

Portland, Ore.—The citizens of the state will vote in November on the issue of bonds for constructing roads.

Amarillo, Tex.—The $70,000 issue of paving bonds has been sold and bids will be asked soon.

Dallas, Tex.—The paving, with Jacksboro rock, of Rawlins st., from Oak Lawn ave. to Coke st., and Coke st., from Rawlins to Hall st., has been ordered by the municipal commissioners.

Dallas, Tex.—Resolutions have been adopted for paving Holme st. and Grand ave. J. B. Winslett, cy. secty.

Haskell, Tex.—A $100,000 county bond issue for good roads will be voted Dec. 8.

Munday, Tex.—This city voted to issue $5,000 bonds for street improvements.

Bellingham, Wash.—New bids will be asked soon for paving Grant st.

Waterville, Wash.—A 13-mile macadam road to cost $25,000 will be constructed from Columbia river to Rock Island.

Milwaukee, Wis.—A municipal asphalt plant will be built next year; to cost about $5,000.

Front Royal, Va.—Voted to issue $30,000 bonds for road improvements.

Jonesville, Va.—Lee county will vote, Nov. 29, on $350,000 bonds for road construction.

New Westminster, B. C.—A resolution has been passed for construction of cement and concrete sidewalks, paving roadway and boulevard.

CONTRACTS TO BE LET.

Pine Bluff, Ark.—Bids will be received Dec. 5 for constructing and repairing 9.6 miles of gravel road together with necessary culverts and cross drains. Estimated cost $41,000. W. J. Parkes, 107½ Main st., Pine Bluff, Ark., engr.

Perry, Fla.—Bids will be received on Dec. 5 for the construction of 400 to 800 sq. yds. of cement sidewalk for court house walks. John C. Calhoun, clk.

Jeffersonville, Ind.—Bids will be received on Dec. 5 until 10 a. m. for the construction of a gravel road in Bethlehem township. Peter Nachaud, aud.

Kokomo, Ind.—Bids will be received on Dec. 7 for the construction of gravel road in Center township and one on line dividing Harrison and Honey creek townships. E. B. Esterling, aud.

Lafayette, Ind.—Bids will be received on Dec. 9 until 10 a. m. for the construction of a gravel road in Wabash township. John P. Foreman, aud.

Liberty, Ind.—Bids will be received on Dec. 5 until 2 p. m. for construction of a gravel road in Center township. Clinton Gardner, aud.

Logansport, Ind.—Bids will be received Dec. 7 until 10 a. m. for construction of the Thomas J. Wisely road in Boone township. Bonds required. Geo. W. Conn, audt.

Logansport, Ind.—Bids will be received until 10 a. m. for construction of the Charles E. Beckley road in Boone township. Bond required. Geo. W. Conn, audt.

Logansport, Ind. — Bids will be received Dec. 7 until 10 a. m. for construction of the Melvin Tucker road in Harrison township. Bond required. Geo. W. Conn, audt.

Logansport, Ind.—Bids will be received Dec. 6 until 10 a. m. for the construction of the Charles E. Wolf road, in Boone township. Bond required. Geo. W. Conn, audt.

Peru, Ind.—Bids will be received on Dec. 6 for the construction of 3 gravel roads in Washington township. Charles Griswold, audt.

Rensselaer, Ind.—Bids will be received on Dec. 6 until 12 m. for construction of fine stone road improvements in Kenner township. James N. Leatherman, audt.

Scottsburg, Ind.—Bids will be received on Dec. 5 for the construction of 2 gravel roads in Lexington township. Frank Gardner, audt.

Wabash, Ind.—Bids will be received on Dec. 6 until 10 a. m. for furnishing all material and the construction of 2½ mis. of Purdy free gravel road, in Pawpaw township. Bond required. J. P. Noftzger, audt.

Wabash, Ind.—Bids will be received on Dec. 6 until 10 a. m. for improvement by grading and macadamizing of highways in Noble township, J. W. Murphy et al. gravel road and the Herman Wolf et al. gravel road. Personal or surety bond required. J. P. Noftzger, audt.

Wabash, Ind.—Bids will be received on Dec. 6 until 1 p. m. for furnishing of material and construction of 3 miles of the Hoover free gravel road, in Chester township. Bond required. J. P. Noftzger, audt.

Wabash, Ind.—Bids will be received on Dec. 6 until 10 a. m. for improvement of highway known as the Samuel E. Eby et al., in Pawpaw township. Personal or surety bond. J. P. Noftzger, audt.

Williamsport, Ind.—Bids will be received on Dec. 5 until 1 p. m. for construction of a gravel road in Jordan township. R. C. Winks, audt.

Williamsport, Ind.—Bids will be received on Dec. 10 for the construction of gravel road in Pine township. R. L. Winks, audt.

Ft. St. Philip, La.—Bids will be received on Dec. 7 until 11 a. m. for the construction of roads and walks at Ft. St. Philip. George B. Davis, Q. M., Hibernia Bank bldg., New Orleans, La.

New Orleans, La.—Bids will be received on Nov. 29, for paving with small granite blocks on a concrete foundation the roadway on the river front from Thalia to Bienville sts. Hugh McCloskey, prest. bd. comrs.

Crookston, Minn.—Bids will be received on Dec. 18 until 8 p. m. for paving Ash and Thirteenth sts. with asphalt. A. M. Childs, cy. clk.

Gulfport, Miss.—Bids will be received on Dec. 6 for furnishing material and constructing about 10,000 sq. yds. cement sidewalk. Louis M. Hudson, st. comr.

New York, N. Y.—Bids will be received on Dec. 8 until 3 p. m. for furnishing material and labor for resurfacing the speedway of Ocean Parkway, between Ave. J. and King's Highway, boro of Brooklyn. Chas. B. Stover, prest.

Cincinnati, O.—Bids will be received on Dec. 6 for improving Hill road. F. Dreihs.

Cincinnati, O.—Bids will be received on Dec. 2 for improving North Bend road, from Harrison pike to north corporation line of village of Cheviot. F. Dreihs.

CONTRACTS AWARDED.

Birmingham, Ala.—The contracts for brick paving and sidewalks were awarded to F. W. Jordan Construction Co.; $54,850.

Florence, Ala.—Contract for the building of sidewalks on Cypress Hills road was awarded to J. H. Angel & Co.

Montgomery, Ala.—The contract for paving Madison ave. was awarded to the Southern Bitulithic Co.

Montgomery, Ala.—The contract for paving sidewalks was awarded to J. S. Connift & Co.; $24,000.

Little Rock, Ark.—The contract for paving portions of Rock and Scott sts. was awarded to M. D. L. Cook; $40,000.

Phoenix, Ariz.—The contract for construction of highway was awarded to R. Toobey & Sons, Phoenix, for $55,000.

Little Rock, Ark.—The contract for paving Rock and Scott sts. from 4th to 15th, with asphalt concrete, was awarded to M. D. L. Cook for $40,000, and the contract for paving Main st., from Markham to 10th sts., with wooden blocks, to E. J. Wetterstrom, of Chicago, Ill., for $50,000.

Los Angeles, Cal.—The contract for paving with asphalt on South Park ave., from Jefferson to 58th st., cement curb and vitrified block gutter, was awarded to Fairchild-Gilmore-Wilton Co., Pacific Electric bldg., for $73,458.

Los Angeles, Cal.—The contract for street improvements was awarded to L. H. McGowan, for $11,289.

Los Angeles, Cal.—The board of public works has awarded the contract to Earl F. Low, 240 S. Hill st., at $7,727, for improving Figueroa st.

Los Angeles, Cal.—The contract for grading, graveling, cement gutter and vitrified block gutter was awarded to Geo. H. Oswald, for $7,268.

Oakland, Cal.—The contract for paving with Hassam pavement the 12th st. dam was award to the Covault Co.; $8,438.

Riverside, Cal.—The Star Cement Co. was awarded the contract for improving Lime st., at $7,723.

Riverside, Cal.—The contract for macadamizing Pepper st. was awarded to Shull-Tucker Co., at $9,789.

Sacramento, Cal.—The contract for constructing 2 miles of street in Maple Park division was awarded to Piedmont Construction Co., of Oakland; $90,000.

San Diego, Cal.—The contract for paving D st., from 15th to 25th, was awarded to Fairchilds-Gilmore-Wilton Co., Pacific Electric bldg., Los Angeles, $26,131.

San Francisco, Cal.—The contract for an asphalt road between Lombard st. gate and guardhouse, at the Presidio, was awarded to Flinn & Treacy, San Francisco, Cal.; $9,900.

San Francisco, Cal.—The contract for laying asphalt pavement at the Presidio was awarded to Flinn & Treacy, San Francisco, Cal.; $9,900.

San Jose, Cal.—The contract for road improvements was awarded to F. W. Wehner, at $9,000.

Denver, Colo.—The contract for the work in South Denver improvement district No. 7, including grading and concrete curb and gutter, was awarded to J. F. Roberts; $40,981.

Canaan, Conn.—The contract for 3,000 lin. ft. of gravel-telford road, on the Point of Rocks road, including one reinforced concrete arch culvert, was awarded to T. H. Gill Co., Winter Hill Station, Boston, Mass.

Danbury, Conn.—The contract for 5,550 lin. ft. of gravel-telford road, on the Norwalk-Danbury turnpike, was awarded to the Lane Construction Corporation, Meriden, Conn.

Naugatuck, Conn.—The contract for 3,300 lin. ft. of gravel-telford road, 2 12-in. and 1 24-in. tile culverts, was awarded to the Lane Construction Corporation, Meriden, Conn.

Norfolk, Conn.—The contract for 6,400 lin. ft. of gravel-telford road, on the Norfolk-Winsted turnpike, 3 12-in. and 3 15-in. tile culverts, was awarded to A. D. Bridge's Sons, Inc., Hazardville, Conn.

Plainfield, Conn.—The contract for 11,230 lin. ft. gravel-telford road, on the Plainfield-Jewett City turnpike, was awarded to Jones & Polcaro, Willimantic, Conn.

Redding, Conn.—The contract for 3,241 lin. ft. gravel-telford road, including 2 12-in. and 2 24-in. tile culverts, on the Danbury-Norwalk turnpike, was awarded to Jenks & Goepple, Wilton, Conn.

Ridgefield, Conn.—The contract for 11,997 lin. ft. gravel-telford road, including 4 12-in., 3 15-in., 1 18-in. and 2 14-in. tile culverts, and 5 reinforced concrete arch culverts, was awarded to O. T. Benedict, Pittsfield, Mass.

Southbury, Conn.—The contract for 5,055 lin. ft. of gravel-telford road, 3 15-in. and 1 24-in. tile culverts, was awarded to Chas. W. Tryon, Meriden, Conn.

Fort Dade (Egmont Postoffice), Fla.—The Edwards Construction Co., of Tampa, Fla., has been awarded the contract, at $7,913, for furnishing 33,200 sq. ft. of concrete road and 2,650 sq. ft. of concrete walk at Fort Dade.

East St. Louis, Ill.—Paving contracts were awarded, Oct. 20, as follows: Paving alley between 12th and 13th sts. and College ave. and State st., $4,688, and improving Rock road from 9th to 19th st., $2,917, Meyer Construction Co., of St. Louis; improving Brady ave., C. A. Horn, of East St. Louis, $21,923; Kansas ave., Gaynard & Sweeney, of East St. Louis. $7,832.

Galesburg, Ill.—The contract for laying S. Seminary pavement was awarded to J. B. McAuley, at $26,859.

Harvey, Ill.—The contract for paving with brick on Columbia ave. was awarded to Smith & Brown, Chicago, Ill.

Highland Park, Ill.—The contract for

paving Gage ave. with macadam was awarded to the Schmidt Construction Co., at $5,629.

Peoria, Ill.—Work on the paving of S. Adams st., from Bridge to Hamilton sts., with creosote blocks, is to be started immediately, the board of local improvement having awarded the contract at a meeting held recently to Brewster & Evans, of Peoria, at $34,491. This was the lowest bid of the six received. George F. Simmons, prest. of bd.

Bloomfield, Ind.—The contracts for construction of gravel roads were awarded as follows: Elliott road, in Washington township, to Frank Musselman, Newberry, $4,605; Clayton road, in Stockton township, to Fred Carpenter and R. M. Stafford, Lyons, $4,600, and the Davhoff roads, in Jefferson township, to Samuel Hayes, Worthington, $5,298.

Bloomfield, Ind.—The contract for construction of gravel road was awarded to Thomas E. Slinkard, of Lyons, at $11,111.

Danville, Ind.—The contract for road construction was awarded to McMahon & Co., Fortville, at $25,258.

Wabash, Ind.—The contract for construction of gravel road was awarded to C. M. Wales, of Converse, at $7,825.

Fort Scott, Kans.—The paving of Market square was awarded to the Midland Construction Co., 1,600 sq. yds., $1 per yard; Main st., to same, 10,824 yds.; total, $15,484.84.

Junction City, Kans.—The contract for paving 10½ blocks in residence section was awarded to Flower Bros.; $32,000.

Olathe, Kans.—The contract for constructing 4½ miles of rock road was awarded to Ransom & Cook, of Ottawa, Kans., for $30,456.

Crowley, La.—The contracts for concrete crossings and for walks connecting up crossings were awarded to De Jersey & Barnard, Crowley.

Boston, Mass.—The contract for macadam road in Addison st. was awarded to James Doherty, 133 Calumet st., Roxbury; $14,049.

Boston, Mass.—The contract for paving with asphalt Massachusetts ave. was awarded to Warren Bros. Co., at $8,499.

Boston, Mass.—The contract for construction of vitrified brick pavement at the navy yard was awarded to Central Construction Co., of Boston; $7,381.

Flint, Mich.—The contract for brick paving, with asphalt filler, was awarded to J. T. Lynch, at $8,805.

Rochester, Minn.—Eight blocks of curbing and paving on Broadway were awarded to the Kettle River Co., Minneapolis; $62,353.59.

Tarkio, Mo.—The contract for paving Main st. was awarded to Wellman & Olson, St. Joseph; $25,000.

Omaha, Neb.—The contract for repaving Broadway, from 1st to 6th sts., with Galesburg blocks, was awarded to E. A. Wickham, at $27,030, and contracts for paving, amounting to $70,000, were awarded to National Construction Co.

Portsmouth, N. H.—The contract for paving Islington st. was awarded to Thos. Fitzgibbon, Beverly, Mass.; $4,300.

Asbury Park, N. J.—The contract for 8,450 sq. yds. of wood block paving on Cookman ave. was awarded to United States Wood Preserving Co., 165 Broadway, New York, N. Y.; $21,336.

Newark, N. J.—The contract for building new road near the city was awarded to the Horrigan Contracting Co., at $1,680.

Newark, N. J.—The contract for paving Union ave., Belleville, was awarded to Philip and Peter Jannarone, at $13,434; paving Gregory ave., West Orange, Donato Fusco, at $13,833.

Westfield, N. J.—Contracts for street improvements were awarded as follows: 4,000 cu. yds. excavation; 4,910 sq. yds. 6-in. and 10,200 sq. yds. 4-in. macadam; 3,860 lin. ft. concrete curb and gutter, etc., to Weldon Construction Co., Rahway; 3,630 sq. yds. 6-in. and 4,500 sq. yds. 4-in. macadam and 7,080 sq. yds. macadam resurfaced, all with Tarvia X binder; 5,700 lin. ft. concrete curb and gutter, etc., to Daniel Donovan, 140 W. 25th st., Bayonne; 980 lin. ft. vitrified brick gutters, 1,150 lin. ft. curb reset, and 1,610 lin. ft. new curb, to Monroe Paving Co., 509 Betz bldg., Philadelphia.

Albany, N. Y.—The contract for the improvement of Myrtle ave. was awarded to Henry Dumary; $12,218.

Bronxville, N. Y.—The contract for paving Avon road, in Sagamore, and constructing sewers thereon, was awarded to Bellew & Merritt, at $16,486.

Fairport, N. Y.—The contract for construction of sewers in South Main and Polk sts, was awarded to Wagner & Dancy, East Rochester.

Chardon, O.—The contract for paving one mile of road in Hampton township was awarded to the Cement Products Co., Erie, Pa.

Clyde, O.—The paving of part of Amanda and Buckeye sts. with Deckman-Duty brick was awarded to J. C. Smith, Lorain, O.

Eaton, O.—The contract for paving various streets with Paris stone was awarded to Jenkins & Hines, Frankfort, Ind.; $10,500.

Marysville, O.—The contract for the improvement of the public highway south of Milford Center was awarded to Welsh & Jones, at $4,500.

Toledo, O.—The contract for paving various streets with bituminous macadam, Carbo Via treatment, was awarded to France Co., Toledo, at $21,621.

Ft. Sill, Okla.—The contract for concrete walks was awarded to J. R. Laughlin Topeka, Kans., at $5,257.

La Grande, Ore.—The contract for the paving of 4th st., from Adams to O st., was awarded to the Warren Construction Co., Portland, Ore.

Portland, Ore.—The following contracts have been awarded: Street paving, to Warren Construction Co., Beck bldg., $19,622; grading and concrete curbs, to Stevens Bros., 590 E. 10th st., $2,494; grading and concrete curbs, to M. Houson, 523 Grant st., $6,573.

Kitanning, Pa.—The contract for brick and macadam paving and also concrete curbing was awarded to John Schaffner, Butler; $39,592.

Philadelphia, Pa.—Contracts have been awarded as follows: Paving 35 sts., to Barber Asphalt Paving Co., Land Title bldg.; paving 10 sts., to Filbert Paving & Construction Co., Penn bldg. Improvements will aggregate $100,000.

Punxsutawney, Pa.—The contract for street paving was awarded to P. E. and P. J. McGovern, at $12,342.

Memphis, Tenn.—The contract for paving Peabody ave. has been awarded to the Memphis Asphalt & Paving Co., at $35,260, and H. P. Streicher & Co. received the contract for the extension of Madison ave. from Cooper st. to the Parkway, at $19,130. Asphalt will be used on both streets.

Galveston, Tex.—The contract for constructing shell road from Missouri City,

Richmond, Tex., was awarded to W. D. Haden, at $81,745.

Puyallup, Wash.—The contract for the paving of Poplar st. was awarded to the Warren Construction Co., Portland, Ore.

Seattle, Wash.—Contracts for street improvements have been awarded as follows: Planking Oliver st., Wm. Kopka, city, $9,496; concrete walks, Whitman ave., Packard Spring Co., city, $25,768; brick paving and granite curbing, 3rd ave., Grant Smith & Co. & Stillwell, city, $81,000.

Seattle, Wash.—The following contracts have been awarded: Improving Lane st. and others, to W. H. Smith, $6,623; Green st., from Rainier ave. to 32d ave., South, to Rufus Buck, $5,803; Rainier ave., from 57th ave., South, to Ryan st., to Anderson, Peterson & Co., $34,802.

Tacoma, Wash.—The following contracts have been awarded: Construction of walks in district 733, to Smith Cement and Brick Co., 722 Commerce st.; for walks and grading in district No. 777, to Pacific Fuel Co., 1950 South C st.

St. Catherines, Ont.—The contracts for the paving of Queenston and King sts. were awarded to the Warren Paving Co., of Toronto, Canada, at $59,000.

SEWERS.

CONTEMPLATED WORK.

Birmingham, Ala.—A storm sewer, to cost about $300,000, is contemplated.

Tucson, Ariz.—The city clerk has been instructed to let contract for 23,000 ft. of sewer pipe and fittings.

Orange, Cal.—It has been decided to lay sewers in Chapman ave., Cypress, Lemon and various other streets.

San Francisco, Cal.—The board of supervisors has authorized construction of sewers in section C2 of North Point main sewer system; cost, $85,000.

Los Angeles, Cal.—The residents and property owners in San Pedro have petitioned the city council to construct a storm sewer system for the protection of the business district of that part of Greater Los Angeles.

Monrovita, Cal.—A $120,000 bond issue for sewers has been voted.

Winsted, Conn.—This city voted to install a sewer system. Borough warden.

Macon, Ga.—Consulting Engineer J. W. Wilcox has completed plans for 1 mile of sewers.

Rome, Ga.—A $50,000 bond issue for sewers will be voted on Dec. 6.

Nampa, Idaho.—A sewer system, consisting of 8-in. to 15-in. vitrified pipe, is contemplated. It is said that bids on part of the work will be received about Jan. 1.

Sigourney, Ia.—A bond issue of $35,000 has been voted for the construction of a sewer system.

Paris, Ill.—A bond issue of $15,000 has been voted for sewer on Big Four right of way. Cy. clk.

Seymour, Ind.—Bids will be received by board of public works for the laying of 400 lin. ft. of 12-in. vitrified pipe sewer.

South Bend, Ind.—Plans are being designed and bids will be asked by Jan. 1 for installing a trunk sewer system in the southern part of this city. Wm. S. Moore, cy. engr.

Lyons, Kans.—Plans are in progress for complete sewer system, consisting of 8 miles of sewers and laterals, 8 to 15-in. pipe. Cost, $65,000.

Easton, Md.—Plans for sewers and sewage disposal works will be made by Clyde Potts, 30 Church st., New York.

Dawson Springs, Ky.—An engineer is wanted to design a small system of sewers. Town clerk.

Boston, Mass.—It is reported that the street and water commission will construct sewers in Edmund and Woodlane sts.

Battle Creek, Mich.—A sewer system has been decided upon. Cost, about $6,000.

Detroit, Mich.—Bids for the construction of lateral sewer will be advertised for soon. J. J. Haarer, comr.

Grosse Pointe Park, Mich.—Plans will be prepared for constructing a sewerage system. Vil. trustees.

Brainerd, Minn.—All bids for sewer in districts Nos. 4 and 5 have been rejected.

Owatonna, Minn.—Will vote, Nov. 8, on the issue of $30,000 sewer and paving bonds.

South St. Paul, Minn.—An extension of the Grand ave. sewer, a distance of about 40 blks., is under consideration.

Virginia, Minn.—An ordinance has been passed providing for the establishment of a sewer district, No. 4.

Meridian, Miss.—Bonds to the total of $60,000 for sewer and drainage extensions have been sold.

Cameron, Mo.—Plans for 8 and 10-in. lateral sewers have been prepared by Engineers Seit & Peterman, Corby bldg., St. Joseph, Mo.

Mexico, Mo.—Plans for 3,000 ft. of sewer are being prepared. E. F. Ketler, cy. engr.

Conrad, Mont.—Bids will soon be asked for the construction of a sewer system.

Whitefish, Mont.—Engineer Jaquith will have plans completed by Dec. 1 for sewer system here.

Madison, N. J.—It has been decided to lay the sewers on Madison ave. up to Loantaka instead of Morris Place.

Newark, N. J.—Ordinances have been passed for concrete sewers on Thomas and Dawson sts. and Avenue C. Bd. of st. and water comrs.; M. R. Sherrerd, chief engr.

Port Jefferson (L. I.), N. Y.—The installation of a sewerage system is contemplated, and a committee has been appointed to circulate a petition among the property owners.

Port Jervis, N. Y.—A sewer will be laid on Richard ave.

Rochester, N. Y.—A public hearing was held Oct. 19 on the ordinance appropriating $500,000 for the purpose of constructing intercepting sewers, as a part of the proposed plan for sewage disposal and to avoid pollution of the lower river.

Rome, N. Y.—Plans for a $1,000 sewer extension have been prepared. Cy. engr. Plunkett.

Yorkville, N. Y.—Voted in favor of the proposition for constructing a sewer system which will cost about $22,000.

Ashtabula, O.—Plans are being prepared for a sewer in Middle st.

Cincinnati, O.—Plans for $14,043 of sewer construction have been prepared by Cy. Engr. Shipley.

Cleveland, O.—About Dec. 1 bids will be received for the construction of a brick and concrete sewer. I. A. Greenwood, 307 City Hall.

Lancaster, O.—The city engineer has been directed to prepare plans and specifications for constructing sewers in Frederick st. and the Wm. Cox addition.

Portsmouth, O.—Bids will be asked

early this month for a new sewer between 3d and 4th sts.

Wilmington, O.—The construction of a drainage and sewerage system is contemplated at a cost of about $90,000.

Newburg, Ore.—Voted, Oct. 4, to install a sewerage system.

Portland, Ore.—The city engineer has prepared plans for sewers in the following streets: Curlett, Texas and others.

Portland, Ore.—Bids will soon be asked for construction of Holgate sewer extension in Brooklyn district.

Allentown, Pa.—A committee of 15 has been appointed, with Col. Harry C. Trexler, chairman, to devise a plan for constructing a sewerage system.

Beaver Falls, Pa.—Preliminary work on a complete sewer system is to start soon. Bids have been received on the engineering work.

Carbondale, Pa.—About $50,000 will be expended for pipe sewers. Engr. B. D. Anthony, Carbondale.

Lansdowne, Pa.—The construction of a sewage disposal plant is being considered for the sewage of the boroughs of Lansdowne, Yeadon, Aldan, Clifton Heights and other municipalities.

Marcus Hook, Pa.—An ordinance has been passed for constructing a sewer in E. 9th st. R. L. Elliott, prest. of coun.

Masontown, Pa.—The citizens have voted $25,000 of bonds for water works and sewer systems.

McKeesport, Pa.—The city engineer has been instructed to prepare plans for a sewer system, as required by the state bd. of health.

New Philadelphia, Pa.—Plans for construction of a sewer system will be completed about Nov. 15. Geo. E. Arnold, cy. engr.

Mitchell, S. D.—The contract for constructing 9,929 ft. of 8-in. pipe sewers and 25 manholes was awarded to E. L. Dimick, Laurel, Neb.; $6,492.

Dallas, Tex.—Plans for a storm sewer on Swiss ave. have been adopted by the cy. commrs.

Bryan, Tex.—The city council has agreed to begin work at once on the municipal sewer system.

Ft. Worth, Tex.—Plans for a large sewer system are being prepared.

Richmond, Va.—Bids will be asked soon for the following sewers: Lombard st., $33,560; Sycamore st., $38,488; Meadow st., $439,689; Hampton st., $68,-138. Chas. E. Bolling, cy. engr.

Chehalis, Wash.—City council passed ordinance authorizing the installation of a $55,000 sewer system. The contracts will not be let till spring.

Everett, Wash.—It is reported that Phillips & Son will be awarded the contract to construct a sewer in Maple st.; $3,035.

Olympia, Wash.—The city engineer will complete the Swanton sewer.

Vancouver, Wash.—City Engineer H. H. Latta has plans under way for trunk and lateral sewers, amounting to $50,000 or $75,000.

Moundville, W. Va.—A bond issue of $166,900 has been voted for a sewer system. Engineer not yet selected. O. B. Boner, cy. clk.

Laramie, Wyo.—Voted in November on the issue of $15,000 for improving the sewer system.

New Westminster, B. C.—A resolution has been passed providing for construction of storm sewers on 3rd st., from Royal ave. to 6th ave.

Waterville, Ont.—Considering the construction of sewage disposal plant.

CONTRACTS TO BE LET.

Elwood, Ind.—Bids are being received for sewer, 1,000 ft. long, in West South K st. and 13th. John Nearon, clk.

Shelbyville, Ind.—Bids will be received on Dec. 29 for construction of sanitary sewer system. L. E. Webb, cy. clk.

Louisville, Ky.—Bids will be received on Dec. 2 for construction of a sewer known as 8th and St. Catherine sts. sewers. J. B. F. Breed, chief engr.

Louisville, Ky.—Bids will be received on Dec. 2 for construction of sewers. P. L. Atherton.

Springfield, Minn.—Bids will be received on Dec. 2 for the construction of a 370-ft. 8-in. branch sewer in O'Connell st. John A. Eichmann, recdr.

Newark, N. J.—Bids will be received on Dec. 1 until 3:15 p. m. for the construction of a storm water sewer in Ave. C and Dawson st. Bd. of st. and water commrs.

Brooklyn, N. Y.—Bids will be received on Dec. 7 until 11 a. m. for the construction of sewers in various streets. Alfred E. Steers, prest. boro of Brooklyn.

Newburg, N. Y.—Bids will be received on Dec. 5 until 5 p. m. for the construction of a trunk sewer in Lake st. and lateral in Broadway to Lake st. Wm. J. Blake, cy. engr.

Akron, O.—Bids will be received on Dec. 1 until 12 m. for the installation of sewer in and along Euclid ave., from Schell to Wabash ave. Cy. clk.

Timmonsville, S. C.—Bids will be received Dec. 7 for building a storm water drainage, approximating 6,000 ft. of lateral drains, brick and concrete and terra cotta pipe, from 12 to 36 in. diameter, including manholes, catchbasins, etc. R. C. Collins, cy. clk.

Olympia, Wash.—Bids will be received on Dec. 23 until 5 p. m. for laying a sewer in the alley running north and south through block 14. J. R. Dever, cy. clk.

Buffalo, Wyo.—Bids will be received on Jan. 6 until 8 p. m. for furnishing material and labor for a sewerage system. Mayor and bd. of trustees, Buffalo, Wyo.

CONTRACTS AWARDED.

Los Angeles, Cal.—The contract for sewer construction was awarded to David Jay, at $25,000.

Los Angeles, Cal.—The contract for sewer construction was awarded to M. Sale, at $6,989.

Ft. Winfield Scott, Cal.—The contract for sewer and water extensions was awarded to K. Ehrhart, San Francisco; $10,255.

Los Angeles, Cal.—The contract for construction of a public sewer was awarded to M. Salas, at $6,989.

Oakland, Cal.—The contract for a sewer in 14th ave. was awarded to Scott & Foley; $13,597.

Denver, Colo.—The contract for subdistrict 2, of South Hill storm sewer district No. 2, was awarded to Westcott Doan Investment Co.; $4,752. Seventh ave. special sanitary sewer district, to Westcott Doan Investment Co.; $7,894.

Denver, Colo.—The contract for subdistrict 9, of East Side sanitary sewer district No. 1, was awarded to Municipal Construction Co.; $22,167.

Denver, Colo.—The contract for sanitary sewer and other improvements was awarded to Westcott-Doan Investment Co., for $12,646.

Newark, Del.—The contract for a sewage disposal plant for the Continental

Fiber Co. was awarded to L. B. Jacobs, Newark, Del.

Clearwater, Fla.—The contract for 2¼ miles of 8 to 15-in. pipe sewer, 4 appurtenances, was awarded to Ira C. Nicholas, of Kissimee, Fla.; $8,000.

Eastman, Ga.—The contract for a sewer system was awarded to F. M. Benner, Marion, Ind.

West Liberty, Ia.—The contract for construction of six miles of sanitary sewers and sewage disposal plant was awarded to C. R. Nichols, Caney, Kans., at $28,655.

Lewiston, Ill.—The contract for construction of sewer and septic tank was awarded to J. E. Bailey, Hamilton, O., at $15,295.

Waukegan, Ill.—The contract for a sewer in Washburn Park was awarded to William Maren, Joliet, Ill., at $17,724.

West Liberty, Ia.—The contract for a sewer system was awarded to C. R. Nichols, Carey, Kans., at $28,684.

Louisville, Ky.—The contract for the construction of section B of Frankfort ave. sewer was awarded to James Ferry & Sons, Pittsburg, Pa., at $25,000.

Albert Lea, Minn.—The contract for constructing sewers in various streets was awarded to Ilstrup & Olson, of Minneapolis, at $5,799.

Duluth, Minn.—The contract for a sewer in 61st alley, west, was awarded to Chas. Ekland, at $3,242, and the sewer in 39th ave., west, was awarded to W. E. Kern, at $4,805.

Neosho, Mo.—The contract for a sewer in district No. 1 was awarded to the United States Construction Co., Vinita, Okla., at $34,950.

Sedalia, Mo.—The contract for a sewer in district No. 43 was awarded to G. W. & A. H. Kemp.

Caro, Mich.—The contract for constructing about 10,055 lin. ft. of 8 to 15-in. sewer was awarded to James W. Collins, of Flint, at $7,392.

Detroit, Mich.—The contract for Fairview public sewer in Jefferson ave. was awarded to Langely & Jaynes, for $55,-587.

Detroit. Mich.—The contract for lateral sewer was awarded to Thos. Whittaker, Detroit, Mich., for $8,708.

Bloomfield, N. J.—The contract for Watsessing storm sewer was awarded to Jas. J. Boylan; $10,781.

South Amboy, N. J.—The contract for a sewer in South Amboy was awarded to P. J. Monahan, South Amboy, N. J., at $26,750.

Sumpter, S. C.—The contract for construction of sewers was awarded to Bingham & Moffitt, of Orangeburg, S. C., for $10,630.

Fairport, N. Y.—The contract for sewers in South Main and Park sts. was awarded to Wagner & Daucey, East Rochester, N. Y.

Niagara Falls, N. Y.—The contract for a sewer in Garfield ave. and one along the New York Central R. R., north of Suspension Bridge, was awarded to the Read-Coddington Engineering Co., at $92,050.

Bellefontaine, O.—The contract for a new sewage system, section 1, was awarded to E. C. McConnell, Kenton, O., $31,503; section 2 was awarded to William McDowell & Son, Cleveland, O., $33,594.

Dayton, O.—The contract for storm sewer in Central ave. and 7th st. was awarded to Hall & Cronin Co., at $22,694.

Carthage, O.—The contract for laying sewers was awarded to John Snyder, Nagood, at $46,000.

Cincinnati, O.—The contract for main and lateral sewers in Marshall ave., Gilmore st., etc., was awarded to Kirchner Construction Co., 800 Plum st., Cincinnati; $54,791.

Cleveland, O.—The contract for drainage system was awarded to Hoag & Zulla; $25,800.

Hamilton, O.—The contract for construction of storm sewer in Milliken st. was awarded to Frank J. Davis, of Hamilton, O.; $5,030.

Hamilton, O.—The contract for construction of a storm sewer in Central ave. and 7th st. was awarded to Hall, Cronin & Co., of Dayton, O.; $22,694.

Hamilton, O.—The contract for construction of storm sewer in 4th, 5th and Vine sts. was awarded to Graver Construction Co.; $15,412.

Youngstown, O.—The contract for construction of Ardale and Wirt sts. sewer was awarded to Hannon Bros.; $12,214.

Youngstown, O.—The contract for construction of Logan ave. sewer was awarded to W. E. Gartland; $15,529.

Youngstown, O.—The contract for a sewer in Phelps st. was awarded to Jno. Grady; $21,013.

Muskogee, Okla.—The contract for construction of storm sewer was awarded to F. P. McCormick, at $57,476.

Neosho, Okla.—The contract for a sewer system was awarded to United Construction Co., Neosho, Okla.; $34,905.

Salem, Ore.—The contract for construction of South Salem sewer system was awarded to Bebee & Stevenson, at $175,000.

Portland, Ore.—The contract for constructing the Riverside sewer was awarded to William Lind, Portland, at $132,005.

Portland, Ore.—The contract for the Laurelhurst addition sewer was awarded to the Barber Asphalt Paving Co., at $41,000.

Portland, Ore.—The contract for the Riverside sewer; reinforced concrete sewer, 7,069 lin. ft., 24 to 43 in.; drain tile, 3,000 lin. ft., 4 to 8 in.; cement sewer, 63,696 lin. ft., 6 to 24 in.; branches on concrete sewer pipe, 1,217 lin. ft.; 1,212 ⅛ bends, 6 in.; 46 manholes; 84 manholes, complete; 19 drop manholes; 69,972 cu. yds. excavation and refilling; 211 concrete inlets, complete; 210 cu. yds. concrete; 1,000 vitrified brick; 100 lbs. steel; 1,050 lin. ft. platform; 170-ft. tunnel; 8,480 lin. ft. piling, left in place; 1,272 lin. ft. piling above cut-off, was awarded to William Lind, 525 E. 16th st., N. Portland, Ore.

Chester, Pa.—The contract for the sewer and water connections with water main in center of street was awarded to J. A. Morgan, 1032 W. 3rd st.

Providence, R. I.—The contract for construction of two sewers was awarded to Chas. Crankshaw, 400 Plainfield st.; $13,717.

Providence, R. I.—The contract for construction of sewers in various streets was awarded to F. E. Shaw, at $27,531.

Pasco, Wash.—The contract for construction of modern sewerage system was awarded to the Newport Engineering Co., of Portland, Ore., for about $66,-226.

Prosser, Wash.—The contract for construction of sewer system was awarded to Atlas Construction Co., Everett, Wash.; $17,811.

Snohomish, Wash.—The contract for the Maple st. sewer, from 5th st. to 1st, and on 1st one block west to trunk sewer, was awarded to Phillips & Son.

New Westminster, B. C.—The contract for laying 20 miles of sewers was awarded to F. T. Sinclair, Revelstoke.

WATER WORKS.

CONTEMPLATED WORK.

Malvern, Ark.—Installation of water works is contemplated.

South Fork, Ark.—Plans are being prepared for a 1,000,000 gallon mechanical filtration plant.

Long Beach, Cal.—Improvement to its present system, including the doubling of its reservoir capacity, is contemplated by the Alamitos Water Co.

Ontario, Cal.—Voted, Oct. 31, to issue $175,000 bonds for new water works.

Daytona, Fla.—City will install 200,000 gallon water softening plant. Geo. A. Main, supt.

Morristown, Ill.—Voted $10,000 bonds for municipal water system.

Newcastle, Ind.—The city is considering improvements to light and water plants.

Adair, Ia.—It has been voted to install a $15,000 water works system.

Frontenac, Kans.—City will build $15,000 water works extension.

Newton, Kans.—Voted bonds for water works improvements.

Stafford, Kans.—Plans have been completed for water works and electric light plant improvements.

Covington, Ky.—Voted, Nov. 8, to issue $100,000 bonds for new reservoir in Devon Park.

Russell, Ky.—Voted to issue $50,000 bonds for water works.

Kenner, La.—It is reported that the St. Charles Land Co. will spend about $150,000 for improvements at Kenner. The work will be the construction of a reservoir, a canal 2½ miles long, also 100 miles of ditches.

Patterson, La.—The city has sold bonds for $30,000 for the construction of water works.

Baltimore, Md.—It is reported that an appropriation of $200,000 has been made for an extra pump at Mt. Royal pumping station.

South Hadley Falls, Mass.—A water system, to cost about $12,000, is contemplated.

Flint, Mich.—Voted, Nov. 8, to issue $400,000 bonds for water works.

Kalamazoo, Mich.—Voted, Nov. 8, to issue $43,000 bonds for water mains.

Minneapolis, Minn.—Proposals for 2 20,000,000 gallon electrically driven turbine type pumps were rejected and will be readvertised. Edw. P. Burch, consulting engr., Minneapolis.

Moorhead Minn.—Bids will be asked for the drilling of 6, 8 and 10-in. artesian wells, to be dug for the city in connection with the proposed water system.

St. Paul, Minn.—Plans for a concrete bridge at E. 7th and Earl sts. have been completed; $35,000.

Taconite, Minn.—Plans are in progress for water main extension, consisting of 2 miles of c. i. water main, including hydrants, gates and valves. Cost, $15,000.

Granby, Mo.—The erection of a new water works plant, to cost $18,000, is contemplated.

Marionville, Mo.—A water and light system will soon be installed.

Grand Island, Neb.—Plans have been completed for improvements to water works and electric light plant, to cost $100,000. H. E. Clifford, cy. clk.

Norfolk, Neb.—Remodeling, increasing and general improvements to water works system are contemplated.

Wynot, Neb.—Bonds amounting to $8,000 were voted by the citizens for the construction of water works.

Coxsackie, N. Y.—An extension of the water works system is planned.

New York, N. Y.—Bids will be requested within 6 or 8 weeks for construction of aqueduct through Manhattan Island to Bryant Park, to cost about $25,000,000.

Fargo, N. D.—An additional reservoir and one or more artesian wells are to be constructed.

Mandan, N. D.—Plans have been completed for water works improvements, to cost about $65,000.

Defiance, O.—The city council has decided the city shall erect and maintain a municipal water plant.

Celina, O.—New bids will be asked by the board of public affairs for water works extension.

Cincinnati, O.—Four water tanks of 1,500,000 gallons capacity are under consideration for the western hills district. Board of public service.

Cincinnati, O.—The ordinance passed by the council, involving the expenditure of $150,000 for the construction of water mains, was signed by Mayor Schwab.

New Lexington, O.—The council has passed an ordinance granting to James Westwater & Co., of Columbus, O., a franchise to build a system of water works in this village.

Portsmouth, O.—$300,000 of bonds were voted for the construction of new water works.

West Covington, O.—Voted $100,000 bonds for new water works system.

Yukon, Okla.—It is reported that bids will be asked for the construction of a water works and sewer system.

Grant's Pass, Ore.—The construction of a large dam at Savage Rapids is contemplated by the Rogue River Power and Irrigation Co.

Gresham, Ore.—An appropriation of $5,000 has been made for a new water system.

Jacksonville, Ore.—A bond issue of $30,000 for water works has been sold.

Portland, Ore.—Voted $2,500,000 bonds for new system of laying water mains and for the erection of municipal docks.

Vale, Ore.—Taxpayers voted $35,000 in bonds to build a gravity water system. This amount to be added to $75,000 to make the gravity system instead of the pumping plant.

Pittsburg, Pa.—Voted $3,100,000 bonds for water works improvements.

Somerset, Pa.—Water works improvements to cost $25,000 are contemplated.

Wampum, Pa.—Voted $10,000 bonds for building water plant.

Gettysburg, S. D.—A bond issue of $18,000 for water works has been sold.

Hecla, S. D.—Bonds for a water works system have been voted.

Morrison, S. D.—A bond issue of $10,000 for water works has been voted.

Johnson City, Tenn.—The installation of 1,406 ft. of 6-in. water pipe in Willow st. and 2,600 ft. of ¾-in. in Carnegie st. has been ordered.

Austin, Tex.—Bonds for $28,000 for the construction of water works were approved.

Ballinger, Tex.—The city has voted $16,000 of bonds for improving the water works.

North Yakima, Wash.—The construction of two new bridges, to cost $30,000, is contemplated.

Marion, Tex.—The city will construct a water system.

Wortham, Tex.—The city will install an $8,000 water works system.

Ellensburg, Wash.—Municipal water system, to cost $300,000, is contemplated.

Oroville, Wash.—The people voted in favor of establishing a water system.

Seattle, Wash.—An ordinance has been passed providing for the laying of water mains in various streets.

Spokane, Wash.—Water mains will be installed in 27th ave., Courtland st., 5th ave. and 16th ave.

Spokane, Wash.—A concrete reservoir will be erected in Lincoln Heights add. B. of P. W.

Vancouver, Wash.—This city will spend $100,000 for water works improvements.

Walla Walla, Wash.—The laying of water mains in various streets is contemplated.

Yacoit, Wash.—Bids will soon be asked for the construction of a gravity water system. Wm. W. Eaton, cy. clk.

Prescott, Wis.—Voted to install complete water works system.

Cheyenne, Wyo.—The city is considering the construction of a filtration plant. Estimated cost, $50,000.

Laramie, Wyo.—Voted $55,000 bonds for water works.

Rouleau, Sask., Can.—City has voted $45,000 for a water works system.

CONTRACTS TO BE LET.

Sacaton, Ariz.—Bids will be received on Dec. 6 for furnishing and erecting a tank and tower at the Pine Indian school. Commr. of Indian Affairs, Washington, D. C.

Pittsfield, Mass.—Bids will be received on Dec. 12, until 2 p. m. for the construction of a dam and reservoir 7 miles S. E. in Washington, 47 cu. yds. masonry; 85 cu. yds. earth and 9,600 rock excavation, 45 acres clearing and grubbing; 4,000 ft. 12, 20, 24-in. vitrified pipe; 1,300 paving cu. yds. paving. A. B. Farnham, engr. bd. or pub. wks.

Windsor, Mo.—Bids are being received for water works system to cost $39,000 by Rollins & Westover, Beals Bldg., Kansas City, Mo. J. J. Chrisman, cy. clk.

Beatrice, Neb.—Bids are requested for construction of water works system. S. A. Free, cy. c'k.

Cimarron, N. Mex.—Bids are requested until Dec. 20 for a gravity supply system of water works, Cimarron Water Co. Engr. T. W. Jaycox, 1608 Broadway, Denver, Colo.

New York, N. Y.—Bids will be received until Dec. 31 for furnishing, delivering and installing water works apparatus and materials. Bd. of wat. sup.

Niagara Falls, N. Y.—Bids will be received until Dec. 5 for the purchase of city pumping station equipment. Thos. H. Hogan, cy. clk.

Niagara Falls, N. Y.—Bids will be received until Dec. 5 at 3:30 p. m. for the purchase of water works equipment. City engr. 4710 Buffalo ave.

Fayetteville, N. C.—Bids will be received until Dec. 15 for furnishing and installing two filter units of 500,000 gals. per day each, including piping machinery, etc. John K. Strange Fayetteville, N. C.

Pittsburg, Pa.—Bids will be received on Dec. 12 for the construction of a dam and reservoir in the town of Washington. Bd. of pub. wks., Frank Haywood, chrmn.

Timmonsville, S. C.—Bids will be received on Dec. 7 for furnishing material and labor for the construction of water works. J. E. Patterson.

Seattle, Wash.—Bids will be received on Dec. 13 for the construction of water works. P. E. Cunningham, Sultan.

Seattle, Wash.—Bids will be received until Dec. 13 for the sale of city pumps, boilers, etc. C. B. Bagley, sec. bd. pub. wks.

CONTRACTS AWARDED.

Modesto, Cal.—The contract for furnishing and installing the pumps for three pumping stations was awarded to Frederick C. Roberts Co., 461 Market st., at $7,751.

Orland, Cal.—The contract for the construction of schedules 1, 2 and 3 of the earth work of the distribution system, Orland irrigation project was awarded to Marce Bros., Concord, Cal., at $10,738.

Redlands, Cal.—The contract for the construction of dam in Yucaipa Valley was awarded to W. S. Hewitt & Co., $12,000.

Washington, D. C.—The contract for furnishing material for water works system was awarded to Lynchburg Foundry Co., Lynchburg, Va.

Thomaston, Ga.—The contract for furnishing hydrants, pipes and valves in connection with the construction of water works was awarded to Glanmorgan Pipe & Foundry Co., Lynchburg, Va., $25,000.

Beecher, Ill.—The contract for laying 16,570 ft. of 6 and 8-in. water mains was awarded to T. H. Iglehart, Rookery Bldg., Chicago, Ill., $14,177.

Chicago, Ill.—The contract for rebuilding of the 68th st. pumping station, removing old and furnishing new boilers was awarded to Babcock and Wilcox Co., 567 W. Lake st., Chicago, $12,998.

Galesburg, Ill.—The contract for a new fly wheel pump was awarded to Snow Pump Works, Buffalo, N. Y., $16,890.

Highland Park, Ill.—The contract for constructing a cast iron internal main water supply pipe 10-in. in diameter, in Linden and Cedar aves. and Sheridan road was awarded to T. H. Egelbart, Rookery Bldg., $10,113.

Highland Park, Ill.—The contract for constructing a cast iron main water supply pipe, 10-in. in diameter, on Linden and Cedar aves. and Sherman road was awarded to T. H. Iglehart, $10,113.

McLeansboro, Ill.—The contract for the construction of 55,000,000-gallon reservoir was awarded to Retzel & Chapman, Evansville, Ind., $13,934.

Morton, Ill.—The contract for laying 3,000 ft. of water mains in eastern part of town was awarded to A. Everett, Washington, D. C.

Rushville, Ind.—The contract for new boilers at the water and light plants was awarded to Heine Safety Boiler Co., 98 Jackson Blvd., Chicago, Ill., $11,068.

Burlington, Ia.—The contract for furnishing pumps and machinery was awarded to Erie City Iron Works, $14,500.

Chanute, Kan.—The contract for furnishing and laying a 16-in. water main was awarded to G. Jaeger, Rich Hill, Mo., $17,230.

Kingsley, Kan.—The contract for furnishing material and laying water pipe, with hydrants, including 2,500 ft. 6-in. and 11,250 ft. 4-in. cast iron pipe, 8 hydrants and 12 valves was awarded to Marshall Bros., Las Animas, Co'o., $9,775.

Medway, Mass.—The contract for new water works system was awarded to F. A. Hondljtte & Son Co., Boston, $90,000.

Millis, Mass.—The contract for laying water pipe was awarded to Hanscom Construction Co.

Ft. Howard, Md.—The contract for three reinforced cisterns was awarded to Jas. A. Boaz, Philadelphia, $5,600.

Bronson, Mich.—The contract for a water works system was awarded to C. L. Olds Construction Co., Fort Wayne, Ind., $21,000.

Detroit, Mich.—The contract for the erection of the Fairview pumping station was awarded to Hunkin-Conkey Construction Co., Cleveland, O., $150,000.

Fairmount, Minn.—The contract for new steel tank and tower was awarded to Des Moines Bridge and Iron Works, Des Moines, Ia., $5,372.

Owatonna, Minn.—The contract for steam pump at water works was awarded to C. W. Tubby, $5,993.

Beatrice, Neb.—The contract for improvements to water works system, including a 1,000,000 gallon reservoir was awarded to Mathew Construction Co., $57,000.

Hohokus, N. J.—The contract for a water supply system was awarded to Partridge & Howe, White River Plains, N. Y.

Binghamton, N. Y.—The contract for constructing Mt. Prospect reservoir, 59,599 cu. yds. excavation, 770 cu. yds. plain concrete, 2,150 cu. yds. reinforced concrete; 1,090 ft. reinforced concrete fence; 4,650 barrels Portland cement; 280,000 lbs. steel for reinforcement; 56,000 lbs. metal work, furnished by city; 2,100 lbs. cast iron, wrought iron and steel; 2,400 ft. vitrified pipe, 6 in. 250 ft. vitrified pipe, 12-in. was awarded to Sand & Gravel Co., East Liverpool O., $54,329.

Buffalo, N. Y.—The contract for hydrants and valves was awarded to Kennedy Valve Mfg. Co., Elmira, N. Y.

Bowbelles, N. D.—The contract for constructing water works was awarded to Geo. W. Kemper, $11,850.

Canton, O.—The contract for furnishing about 800 tons of cast iron pipe and 10 tons of special castings was awarded to the Massilon Iron & Steel Co., Massillon, O., $17980.

Hamilton, O.—Contract for various sizes of wrought-iron pipe was awarded to Scioto Valley Supply Co., of Columbus, O., $16,006.

Enid, Okla.—The contract for installing water works was awarded to Laidlaw-Dunn-Gordon Co., Cincinnati, O., $9,740.

Foraker, Okla.—The contract for the construction of water works was awarded to C. A. Rees.

Brookville, Pa.—The contract for a filtration plant for Brookville Water Co., including a concrete dam, filter plant and pumping station was awarded to American Water Softener Co., 1009 Chestnut st., Philadelphia, Pa.

Chambersburg, Pa.—The contract for gravity conduit was awarded to H. C. Brooks Co., of Clarksburg, W. Va., $39,053.

Saegerstown, Pa.—The contract for erecting reservoir, laying water mains was awarded to Henry Keupple, Olean, N. Y.; for pipe and special castings was awarded to United States Cast Iron & Foundry Co.

Sharpsburg, Pa.— The contract for furnishing and installing two 300-h.p. boilers feed water heater, feed pump and piping was awarded to Oil City Boiler Works, Oil City, Pa., $9,353.

Highmore, S. D.—The contract for construction of water works was awarded to Des Moines Bridge & Iron Co., of Des Moines, Ia., for $14,500.

Dallas, Tex.—The contract for erecting pumping station at White Rock reservoir was awarded to Hughes-O'Rourke Construction Co., $30,050.

Galveston, Tex.—The contract for laying the city main across the channel was awarded to A. M. Blodgett Construction Co., $8,000.

Seattle, Wash.—The contract for laying water mains in Alonzo ave., N. W., was awarded to Dicken & Rightmire, 2728 23rd ave. S., $6,142.

Sultan, Wash.—The contract for constructing water works system was awarded to P. E. Cunningham, city, $11,995.

Walworth, Wis.—Contracts for the following were awarded: Water pipe to United States Cast Iron Pipe & Foundry Co., Chicago, Ill.; valves to Ludlow Valve Mfg. Co., Troy, N. Y.; laying pipe to William Tunny, Joliet, Ill.; pumping machinery to Gould Pump Co., Seneca Falls, N. Y.; tank and tower to Chicago Bridge Co., Chicago, Ill.

Highland Park, Va.—Contracts for the following were awarded: Wells, trenches, pump and pump house to I. J. Smith & Co., Richmond, Va. $4,885; hydrants, pipes and valves to Glamorgan Pipe & Iron Co., Lynchburg, $25,000.

Richmond, Va.—The contract for hydrants, pipes and valves was awarded to Glamorgan Pipe & Iron Co., Lynchburg, $25,000.

Mattawa, Ont.—The contract for 2,700 ft. steel and concrete bridge was awarded to Stewart & Hewitson, of Port Arthur, Ont., $300,000.

BRIDGES.

CONTEMPLATED WORK.

Mobile, Ala.—Voted to issue $500,000 bonds for road and bridge construction.

Valdez, Alaska.—The Copper River Railroad Co. will begin at once to construct a bridge across the Kuskalina river.

Camden, Ark.—The county court has provided $40,000 for the construction of a steel bridge over the Ouachita river, at that place.

Clinton, Ark.—It is reported that a steel bridge across the north fork of Red river, at a cost of $6,000, is contemplated.

Oakland, Cal.—The board of supervisors will shortly ask for bids for the improvement of the Webster st. bridge. Estimated cost, $28,000.

Santa Ana, Cal.—The city clerk has been instructed to advertise for bids for the construction of a bridge on West Fifth st.

Stockton, Cal.—The Stockton Modesto Electric Railway will construct a steel bridge across the Stanilaus river.

Ripon, Cal.—The San Joaquin Valley Electric Ry. Co. will soon let contract for bridges over Stanilaus river.

Peoria, Ill.— About Dec. 1 bids will be received for the erection of a concrete and steel bridge. Estimated cost, $150,000.

Franklin, Ind.—Bids are being received for construction of a steel bridge at Monroe st. W. P. Jennings, audt.

Atchison, Kans.—A steel bridge on 13th st. is contemplated to cost about $5,000. C. T. Hawk, cy. clk.

Topeka, Kans.—The bridge plans of Co. Engr. V. R. Parkhurst were adopted by the co. commrs. and bids will be asked immediately, $126,000.

Harlan, Ky.—$15,000 has been appropriated for the construction of a steel bridge spanning Clover fork.

Escanaba, Mich.—A $40,000 bridge over Escanaba river at Wells is contemplated.

St. Paul, Minn.—Cy. Engr. Rundlett

Cleveland, O.—A petition is being signed by the citizens, asking for the con-

struction of a high level bridge across the Clark ave. route, to connect the East and West Sides of the city. Estimated to cost $1,000,000.

has prepared plans for a cement bridge over E. 7th and Earl sts., to cost about $35,000.

Yazoo City, Miss.—A bridge over Tehevals creek and over Bayou in Beat 4 and over Persimmon Bayou has been decided upon. Contracts will be let Nov. 7.

Jefferson City, Mo.—Plans are being pared for three concrete and steel bridges. C. A. Dierckx, co. clk.

St. Louis, Mo.—About Jan. 1 bids will be received on superstructure of bridge across Mississippi river.

St. Louis, Mo.—A viaduct over railroad tracks at Compton ave. is contemplated. To be concrete and steel and cost about $370,000.

Fairbury, Neb.—In January and February bids will be requested for the construction of a bridge.

Lincoln, Neb.—Concrete bridge at 1st and B sts. is contemplated. Roscoe Ozman, cy. clk.

Omaha, Neb.—The city council has decided to build a new viaduct on 11th st. to cost about $80,000.

Albany, N. Y.—State Engineer and Surveyor Williams approved plans, Oct. 15, for erecting a concrete bridge on the Burdick road.

Yorkville, N. Y.—Voted in favor of the proposition for constructing a sewer system, which will cost about $22,000.

Princeton, N. J.—Bids will be received for widening and repairing bridge over stream at Ewing st. Board of Freeholders.

Cincinnati, O.—Plans for a $300,000 viaduct have been prepared by Bridge Engr. Frank Morris.

Cleveland, O.—The county commissioners have directed Co. Engr. Landes to prepare plans for a 40-ft. bridge over Eddy brook in Branturhl township.

Portland, Ore.—Bids will be requested shortly for erection of the new Broadway bridge.

Bradford, Pa.—Voted Nov. 8 to issue $27,000 bonds for steel bridges across Tuna creek at Main and Mill sts., and for repaving Webster st. with vitrified brick.

Pittsburg, Pa.—Bonds to the amount of $1,975,000 have been voted for bridge construction.

Shippensburg, Pa.—Bids will be requested for construction of bridge over Main's Run.

Nashville, Tenn.—Bridge at Hyde Ferry, on the Cumberland river, will be repaired by Davidson co. commrs.; cost $33,000.

El Paso, Tex.—City Engineer Tood has completed plans for proposed viaducts east of city on Smelter road.

Richmond, Tex.—A bridge across Brazos river is contemplated, at a cost of about $30,000.

Richmond, Va.—Council has authorized st. com. to obtain plans and specifications for bridge to replace present Mayo's bridge. Estimated cost, $350,000, exclusive of site and approaches. Chas. E. Boling, cy. engr.

Aberdeen, Wash.—Bids will soon be ased for construction of a bridge at North Aberdeen.

North Yakima, Wash.—The construction of two new bridges, to cost $30,000, is contemplated.

Spokane, Wash.—Plans have been approved for a 6-arch concrete bridge over Hangman creek at cost of $425,000.

Tacoma, Wash.—The construction of a steel bridge at Eleventh st. and the Puyallup river has been decided upon. Bids will soon be requested.

Milwaukee, Wis.—The construction of a bridge spanning Milwaukee river at Wright st. is contemplated.

North Vancouver, B. C.—A bridge will be erected on the new road leading from car terminus to Rice Lake.

Frederickton, N. B.—Chief Commissioner Morrissy is calling for bids for reconstructing the McBride bridge, in Carleton conuty.

CONTRACTS TO BE LET.

San Diego, Cal.—Bids will be received on Dec. 6 for the construction of 5 bridges on the road between Oceanside and the Orange county line. Estimated cost, $27,000. Bd. of co. supvrs.

Perry, Ala.—Bids will be received on Dec. 5 for the construction of bridge across Econfenes river. John C. Calhoun, clk.

Norwalk, Conn.—Bids will be received on Dec. 20 for building reinforced concrete bridge. LeRoy Montgomery, sec., 51 Wall st., Norwalk, Conn.

Rock Island, Ill.—Bids will be received on Dec. 5 for the construction of a steel and reinforced concrete bridge, 158 ft. span, 16-ft. roadway, creosoted block deck and concrete floor and piers over Rock river. Wallace Treichler, cy. engr.

Vincennes, Ind.—Bids will be received on Jan. 5, for the construction of a bridge across White river. Co. commrs.

Shreveport, La.—Bids will be received on Dec. 8 for the construction of either a steel or wooden bridge in Ward 1 across Horseshoe Bayou, 1½ miles north of Belcher. A. L. Duringer, clk.

Virginia City, Mont.—Bids will be received on Dec. 7 for the construction of a proposed bridge over Madison river. Bd. of co. commrs.

Hastings, Neb.—Bids will be received on Dec. 31 for the annual bridge contract. Adams co. bd. of commrs.

Jefferson, O.—Bids will be received on Dec. 19, until 1 p. m. for a riveted steel Pratt truss bridge. Co. engr.

Courtland, Va.—Bids will be received on Nov. 29 for 9 steel bridges in Southampton county. Cy. clk.

CONTRACTS AWARDED.

Los Angeles, Cal.—The contract for concrete arch bridge and dirt fill bridge over the Arroyo Seco at Pasadena ave. was awarded to Mercereau Bridge and Construction Co.; $118,750.

Modesto, Cal.—The contract for a concrete bridge across Ingram creek and El Puerto creek was awarded to Pacific Construction Co., 16 Califoruia st., San Francisco, $7,183.

Naples, Cal.—The contract for one highway and one railway bridge for Pacific Electric Ry. Co., and Huntington Land Co. was awarded to Peterson & Schmidt, 648 Pacific Electric Bldg., Los Angeles, Cal., $35,000.

Gardner, Ill.—The contract for the construction of a bridge was awarded to William H. Shons, Freeport, Ill., $6,000.

Marion, Ill.—The contract for a steel bridge was awarded to Decatur Bridge Co., $1,295.

Oregon, Ill.—The contract for rebuilding the floor of the Oregon bridge over Rock river was awarded to Bert Abbott, Oregon, Ill., $6,500.

Peoria, Ill.—The contract for the construction of a bridge near the Evans mill property was awarded to Joliet Bridge Co., Joliet, Ill., $1,674.

Bristol, Ind.—The contract for a new steel bridge over St. Joseph river at Bris-

tol, Ind., was awarded to Elkhart Iron & Bridge Co., $15,000.

Indianapolis, Ind.—The contract for 2 bridges, one at Dorman st. and the other at E. 10th st., to Hackedorn Construction Co., Indianapolis, Ind., $18,300.

Lafayette, Ind.—The contract for the construction of Gogin road was awarded to Snyder & Jenkins, Frankfort, Ind., $3,175.

Martinsville, Ind.—The contract for constructing two concrete arch bridges was awarded to E. O. Gilbert, city, $6,031.

Noblesville, Ind.—The contract for the erection of bridge between Marion and Hamilton counties was awarded to John W. Scott, Anderson, Ind., $4,844.

Petersburg, Ind.—The contract for repairing a bridge across the Patoka river was awarded to A. H. Kinman, $5,350.

Des Moines, Ia.—The contract for construction of a steel bridge was awarded to Iowa Bridge Co., Des Moines, Ia., $8,900.

Harlan, Ia.—The contract for steel bridges on Botna ditch was awarded to Iona Construction Co., Harlan, $10,750.

Iowa City, Ia.—The contract for the erection of a steel bridge was awarded to Iowa Bridge Co., Des Moines, Ia., $8,900.

Lonetree, Ia.—The contract for a bridge over Iowa river near Lonetree, Ia., was awarded to Iowa Bridge Co., Des Moines, Ia.

Owensboro, Ky.—The contract for the erection of 332-ft. steel leg bridge with concrete floor and wings, to Vincennes Bridge Co., Vincennes, Ind., $2,360.

Harlan, La.—The contract for construction of 5 bridges over Botna ditch was awarded to Lana Construction Co., $10,750.

Boston, Mass.—The contract to make improvements to pier No. 1, at the Boston navy yard was awarded to C. M. Leach, Boston, $26,673.

Hyde Park, Mass.—The contract for a reinforced concrete foot bridge was awarded to John Zechen, 935 Hyde Park ave., $1,345.

Sedalia, Mo.—The contract for construction of viaduct over railroad tracks in Washington ave. was awarded to Midland Bridge Co., Kansas City, Mo., $12,000.

Springfield, Mo.—The contract for construction of a 30-ft. concrete arch bridge was awarded to Canton Bridge Co., Canton, O., $6,848.

Missoula, Mont.—The contract for a bridge over Nine Mile creek was awarded to O. E. Peppard, Missoula, Mont., $2,880.

Albuquerque, N. Mex.—The contract for the proposed bridge across the Verde river was awarded to Missouri Valley Bridge and Iron Co., Leavenworth, Kans., $18,390.

Syracuse, N. Y.—The contract for the construction of Franklin st. bridge was awarded to Steel Storage & Elevator Construction Co., 730 Main st., Buffalo, N. Y., $38,245.

Yonkers, N. Y.—The contract for a bridge over Nepperhan river was awarded to Kearns & Hart, 280 Nepperhan ave., Yonkers, N. Y. $7,648.

Watertown, N. Y.—The contract for draw bridge at Chaumont was awarded to Sherzer Lift Bridge Co., Chicago, Ill., $7,490.

Celina, O.—The contract for a steel and concrete 125-ft. single span bridge to be constructed over Wabash river was awarded to William Ward, Celina. L. Marsh, co. engr.

Youngstown, O.—Contracts for the folowing were awarded: Bridge on Power road to J. Blim & Son, bridge over Dry run to L. K. Mauser, N. Walnut st., Youngstown, O.; 80-ft. span bridge, concrete or steel at east end of Park to L. K. Mauser, same address.

Nowata, O.—The contract for construction of 25 small bridges was awarded to Canton Bridge Co., Canton, O., $44,000.

Tulsa, Okla.—The contract for construction of steel bridge across the Arkansas river, near Bixby, Okla., was awarded to Canton Bridge Co., Canton, O., $68,970.

Plymouth, Pa.—The contract for Plymouth bridge was awarded to Penn Bridge Co., Beaver Falls, $276,973.

West Branch (Oxford Post Office), Pa.—The contract for removing the old bridge across the Chester river between West Branch and Crozerville and replacing it with a wooden, concrete, stone and iron structure was awarded to Chas. J. Pratt, Lima. The contract for concrete has been sublet to Joseph Rabb, Cheyney.

Wilkesbarre, Pa.—The contract for construction of Plymouth bridge was awarded to Penn Bridge Co., $276,973.

Petersburg, Va.—The contract for the superstructure of viaduct to be erected across the valley of Lieutenant Run was awarded to Roanoke Bridge & Iron Co., Richmond, Va., $40,000.

Seattle, Wash.—The contract for a bridge over Lake Union from Kilbourne st. and Sttone Way to Westlake ave. was awarded to Grant Smith & Co., $63,947.

Wheeling, W. Va.—The contract for repaving 17th st. was awarded to Independent Bridge Co.

Winnipeg, Man.—The contract for a bridge on the Pheasant Hills branch of Canadian Pacific Ry. was awarded to William Newman Co.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Cypress, Cal.—The city engineer is preparing plans for a disposal system.

Columbus, O.—Bids will be asked soon on a $17,000 garbage incinerating plant.

New York, N. Y.—Bids are requested Dec. 27, 12 m., for furnishing all labor and material for construction of the furnaces, steam boilers and appurtenances of the Clayton Destructor. George Cromwell, pres. of boro of Richmond.

Kansas City, Mo.—Two incinerating plants, to cost $50,000, are contemplated. J. E. Smyth, cy. clk.; J. E. Porter, mayor.

Seattle, Wash.—A complete collection and disposal system is under consideration. R. H. Thompson, cy. engr., is preparing plans. Bonds for $400,000 have been issued for the incinerator and $370,000 is available for the collection.

FIRE APPARATUS.

Lewiston, Me.—The purchase of an auto truck is being considered.

Vicksburg, Miss.—The purchase of an auto chemical wagon is contemplated.

Jamestown, N. Y.—Fire committee has recommended the expenditure of $30,000 for engines, combination chemical and hose wagon.

East Providence, R. I.—$5,000 has been appropriated for the purchase of motor driven, combination hose, and chemical truck.

Toronto, Ont.—Rudolph Hering has been retained to report on a garbage disposal system.